Computers and Coordination of Debate. A study on the role of computers for ordering public debates at various levels, from open citizen's polls to formal parliamentary debate.

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European Commission

JRC TECHNICAL REPORTS

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2019

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JRC Science Hub
https://ec.europa.eu/jrc

JRC115574

Luxembourg: Publications Office of the European Union, 2019

How to cite this report: Eric Badouel, Carlo Ferigato, Adrian Puerto Aubel *Computers and Coordination of Debate*, JRC Technical Report JRC115574, November 2019

All images publicly available through the Internet

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Abstract

This report results from a collaboration between the JRC - Ispra (Units H.1 and E.2) and the Inria Research Center located in Rennes. The aim of this collaboration is at understanding the basic principles and the computer programs apt to *coordinate a public debate* with an overall aim at giving the bases for designing such programs. Computer programs for the *coordination of public debate* exist since the beginning of the eighties but recently they have acquired new relevance for the use made of them by public administrations, associations and political parties. The meet of both citizen's needs and public administrations for transparency can today be technically realized with such programs through the present communication means in a more efficient way with respect to the first experiments dating now about forty years. This report aims at covering historical, technical and some theoretical aspects of the use of computers for the *coordination of public debate*.

1. Introduction

With this report we aim at two main targets: first of all to understand the principles that regulate the conduct of public debates when computers can have a role in organizing them and, secondly, to understand how to design and eventually develop computer programs for keeping debates ordered and understandable. These computer programs should also manage the various electronic documents involved in debates since these documents have several important roles. These documents can contain the information eventually needed during the debate or result from the collective authoring of reports and minutes. Moreover, these documents, including their draft versions used in the process, can be seen as synchronization points in the progress of a debate. For example, an hypothetical flow for the minutes can be linked to the following points: 1) distribution of the draft version to the participants, 2) discussion and vote on the final version and, 3) publication.

Public debate is one of the fundamental acts of mankind and involves several actions of coordination and communication that are of interest to Computer Science. In fact, some of these communication and coordination actions can nowadays have computers as actors together with humans. So, as computer scientists, we are interested in the general principles that can *order*, *inform* and *conduct* a debate for exploiting them while designing the computer programs that can participate as actors, at any level, in a debate. The interest of the JRC — as research body of the European Commission — in the use of computer programs for the organization of debates is motivated by their growing use in society. So, advantages and concerns related to the organization of debates mediated by computers should be known in detail before either promoting the use of such computer tools or propose any regulation for them. For example, among the potential concerns for lay citizens, we can indicate the transparency of the role played in the debate by individual actors like members of committees, regulators and experts. Moreover, seen from the perspective of an *open access to data*, the information flow through the various phases of the debate should be clear to both participants and observers. In general terms we believe that, by improving the interactions between citizens and their rulers, one can achieve a better democracy and improve the trust of the public in the political system but, when these interactions are mediated by computers, the designers of the computer tools must be aware of the potential consequences of the choices made at the design stage.

Several perspectives can be considered while reasoning on how a public debate is kept in *order*, *informed* and *conducted*. For example, debates can be distinguished by their *objective* as in table 1.1 or in respect to *strength of the coordination rules* used as in table 1.2. Two other more general perspectives can be considered: *synchronization* among the participants and elements of the debate kept in *order*.

The synchronization in time and space of the participants in a debate is a fundamental aspect. The way synchronization is realized affects mainly software tools for *online deliberation* in opposition to tools supporting the meetings of deliberative assemblies when conducted in the same place and time for all of the participants during *face-to-face* meetings. *Online deliberation*, lacking of coordination in space, must use as main element of coordination the *succession* in time of remote events distributed in space. Typical issues of coordination for *online deliberation* systems arise when asynchronous communication channels, like the e-mail, are used. The case of *face-to-face* meetings is easier in this respect, since both coordination in space and time are guaranteed by the presence of the

Table 1.1.: Walton's classification debates

type of debate	Situation	Arguer's Goal	Dialogue Goal
Persuasion	Conflict of opinion	Persuade other party	Resolve issue
Inquiry	Need to have a proof	Verify evidence	prove hypothesis
Discovery	Need for an explanation	Find a hypothesis	Support hypothesis
Negotiation	Conflict of Interest	Secure interest	Settle issue
Information	Need information	Acquire and exchange information	Produce information
Deliberation	Practical choice	Fit goals and actions	decide what to do
Eristic	Personal conflict	Attack an opponent	Resolve conflict

participants in the debate in a single physical place at the same time. *Rules of procedure* [83] are typically adopted in these cases and computer programs helping the chair of such assemblies have been realized (see section 4.1 below).

A second aspect concerns the elements of debate that are *kept in order*. From the viewpoint of *pragmatics*, the elements kept in *order* are the utterances, or the written contributions, made or presented during the debate. So the regular development of a debate is realized when, for example, all the *motions* are *in order* with respect to the rules adopted (see appendix B for more details). From the viewpoint of *semantics*, the elements kept in order are the *arguments*. In this case a debate progresses when all the *legitimate* arguments are included while all *flawed* arguments are discarded. These points of view, *pragmatic* and *semantic*, are in relation with two distinct traditions of design for tools for the organization of debates, respectively *human-computer interaction* [97] and *artificial intelligence* [8]. As said, these two field of research address the problem of keeping in *order* a debate from two distinct perspectives that are well presented, in their general terms, in [110]. For artificial intelligence, the main point is in representing the *argumentation*, roughly speaking as a a kind of logical *proof*, used during a debate. This involves both traditional techniques of artificial intelligence like *non-monotonic reasoning* as well as new techniques like *diagram-based models* and *dialogue games*. For human-computer interaction, the stress goes on the relations between users and the environment. What is represented, in this case, is not the *knowledge* involved in the debate but the debate as a process. In this case, theoretical aspects coming from *pragmatics*, like *speech-acts theory*, have a main role since they represent how changes in the environment are caused by specific utterances or linguistic acts of the participants in the debate.

Besides the "high-level" distinctions between types of coordination and elements represented by the software tools described briefly above, some more detailed classifications are available. Walton distinguished in [105] seven basic types of debates as in table 1.1. Moreover, phases of a debate can be considered as elements of a classification. In this case, a debate can be considered as composed by an *opening stage*, an *argumentation stage*, and a *closing stage*.

- The *opening stage* identifies the situation at hands and thus the type of debate (for instance, through an explicitation of a difference of opinion). The list of participants involved in the discussion (citizens, experts, decision makers . . .) is given, as well as the discussion format (the rules ordering the debate and the norms that must be ad-

hered to). The opening phase also produces background knowledge and information about the situation.

- During the *argumentation phase*, participants put forward arguments that are critically evaluated according to the argumentation schemes used and the set of associated critical questions. *Rules of order* must ensure diversity of views: all opinions must be able to be expressed and taken into account. Therefore, these *rules* should solicit innovative proposals, even if these are minority proposals, and identify the weaknesses of the proposals put forward so that they are not accepted before all the related issues have been carefully dealt with by detailed and documented arguments. Finally, they must ensure that there are no cognitive biases, misinterpretations (ambiguities) and fallacious arguments. When these conditions are verified, the debate, termed *rational*, achieves both *innovation* and *selection*, which are the two levers that make it possible to arrive at relevant information or rational decision-making (depending on the purpose of the discussion).

- The *closing phase* is used to aggregate the different contributions to the debate. This may take the form of a vote if the purpose of the debate is to make a decision. But in most cases we expect some kind of structured document to be produced (minutes of the meetings, expert report, survey report) that provides some debriefing of the discussion. It can even take the form of a poll if the purpose of the debate is to generate proposals on an issue and to identify key questions, corresponding to cleavages in the discussion, that one wishes to submit to the population concerned by the issue before taking a decision. it can also be recommendations in the form of a complex workflow, for example “we would like to have such additional information, to have expert opinions on such issues and to survey the population concerned on such and such a subject before taking our decision”. Finally when the debate involves imprecise or uncertain data [45, 56], aggregation may involve probabilistic, or possibilistic models [28] or belief functions [90, 57].

Even if a given debate can be classified through the preceding categories, it may well incorporate some sub-debates of a different nature. For instance we may find, in the course of a consultative debate, some steps where the agreement of the participants on a subsidiary issue is sought and require a vote procedure. We may also combine debates of different types to obtain complex making-decision procedures involving information retrieval, expert advices, . . . Moreover, debates can be composed hierarchically (for instance, a deliberation may delegate some sub-issues to a committee of experts) as well as sequentially (for instance, the information collected in some opening phase of a deliberation may be the result of an information seeking discussion). We thus can imagine a language for assembling debates. It should be an higher-order language since, as we mentioned above, the result of a debate is not always given by an explicit value, whatever this value is supposed to be: a decision, a document . . . It may be given as the result of a whole process that is returned in place of the value which is assumed to compute it: *instead of giving you the answer I tell you how you can obtain it.*

In order to classify debates, some other criteria are important such that who participate in the discussion (lay citizens, experts, decision makers . . .), whether there is a deadline for the conclusion (a citizen debate on Internet is an ongoing process but the submission of the expert’s report is usually time-bound), whether the conclusions are binding and require a voting procedure, and whether the produced information should be made available to the public or is confidential. These latter elements can be used for a further classification by considering the *strength of the coordination rules* applied as summarized in table 1.2. In this case, four main categories of debate can be distinguished:

Table 1.2.: Debates by strength of procedural rules

type	aim	preparation	vote	rules	documents produced	documents published
citizen's debate	understand positions pro & con	web page with background	N	no formal rules	list of motivations, quotations	all contributions
deliberative poll, petitions	propose a non binding decision	select sample, experts, reports	Y	protocols	non-binding decision	synthesis of the opinions, report
coordination of political parties	opinion to the direction	statement of the problem	Y	delegation	opinion of the base	vote details
parliamentary debate	formal deliberation	dossier by appropriate services	Y	formal rules of procedure	binding decision	vote details, deliberation, minutes, agenda

- *citizen's debate*, a public debate, on a subject of general interest, open to all the citizens without a deadline;
- *deliberative polling* (also called *informed polling*), a debate restricted to a sample of citizens covering all the classes and interests informed by intervention of experts and subject to some protocol;
- *coordination of political parties*, specific tools for letting the opinion of the members of a political party, an association or a lobby group, be known to the leadership;
- *parliamentary debate*, the highly regulated debate in assemblies leading to binding decisions for the whole group and eventually the citizens represented by the members of the group.

In the context of this report, we cannot cover in detail the whole range of debates described above. As said, our aim is at understanding the principles that computers should adhere to while participating in the organization of debates. While considering, in this report, the whole context of the categories of tools listed in table 1.2 above, we will presently give more importance to the first category, the case of *citizen's societal debate*. Some reflections on this particular case are the subject of section 2. A particular case is not listed explicitly in table 1.2. It is the case of debates of *committees at the European Commission*. These debates are of interest since specific *rules of procedure* are adopted for them and they could be an interesting field of application for a computer tool supporting their coordination. This topic should be subject to a more complete study since the legal aspects involved in it are not simple. Some, possibly incomplete, notes for treating this kind of debates are reported in appendix A.

In section 3 we give an introduction to the theoretical foundations to the organization of debate used both by the *artificial intelligence* and *human-computer interaction* communities. In this section, both the aspects related to the theory of argumentation and the

pragmatics of communication are treated as basic elements for the design of computer tools for the coordination of debate. In section 4 we present in detail a sample of the existing software tools. The choice is for tools that well represent the classes given in table 1.2 above.

As said at the beginning of this introduction, the documents used and produced during the development of a debate can play a fundamental role since they represent coordination points in the flow of information. The final part of Section 4 reports briefly about the distinct types of documents involved in a debate, their possible classification through *ontologies* and *thesauri*, and the possible use of a mark-up language, *Akoma Ntoso*, for this classification task. Section 5 is our proposal for the use of a specific formalism, the *guarded attributed grammars*, as a modelling tool for debates and related documents.

Among the appendices, Appendix B is a list of *performative prefixes* to phrases changing the *state* of a debate within the *language-action* theory as presented in section 3 in relation with the *parliamentary debate*. Appendix C, *Information and Communication Technology in Parliaments*, includes the theme of the conduct of debates assisted by computers in the more general subject of the use of Information and Communication Technology, ICT, in parliaments. A specific case for the European Parliament and some relations with the *Open Data Initiative* are mentioned in this appendix. Appendices D and E are basically excerpts from various sources summarizing, respectively, the theory of *Douglas Walton* and the *pragma-dialectical* theory of argumentation.

2. Citizen Societal Debate

In Europe, many experiments have been carried out to solve the problem of the social acceptability of political decisions by involving more citizens in group decision making [97, 63]. Some of them like the consensus conferences introduced in Denmark or James Fishkin's deliberative opinion poll do not rely on computer tools. However, there is now a growing number of computer-assisted deliberative systems, some of which are presented in this document. Most of them intend to empower citizens to collectively create proposals, comment on the existing parliamentary debates, and suggest changes to laws and processes.

The citizen debates which we envision are quite different. For this reason we think that it is useful to devote a few paragraphs to explain the motivations and practical organisation of what we term a *citizen societal debate*.

Our starting point is the observation that in Democracy the public opinion matters. Indeed political rulers must obtain citizen adhesion, if only to get elected and when they are elected for their decisions to be accepted. Hence, of course, the temptation to manipulate public opinion. Rulers would keep the public in ignorance of some issue in order to subject the citizens to the decisions of the experts who serve their interests. Or at least they would avoid involving citizens in debates whose conclusions could oppose their choices. Politicians often claim to listen their fellow citizens and to respond to their requests. But most often than not, they have only met their activists or supporters who tell them what they want to hear, and the debate remains confined to communities that share the same opinion.

There is a genuine interest in reappropriating one's opinion and confronting it with divergent perspectives.

A true democracy should focus on building a shared understanding of the world we live in and the problems we are facing. And from this common understanding it must encourage the development of an informed and unmanipulated public opinion.

As John Dewey put it [27] "*The man who wears the shoe knows best that it pinches and where it pinches, even if the expert shoemaker is the best judge of how the trouble is to be remedied*". Thus for Dewey democracy should not confined to occasionally consulting the citizen by means of universal suffrage. It must be "participatory". This assumes that citizens are fully informed about the issues, and then that they can participate collectively in the development of solutions to the problems they are concerned about.

The first step in a participatory process is therefore that the public be fully informed. In this respect the situation has drastically changed with the advent of Internet. Nowadays, any citizen can access to a wealth of information, including reports produced by institutions and made available as open data. Young people living in poor or backward countries see what is happening elsewhere and want changes to happen at home. So, if only because of the information it provides and its universal nature, Internet has impacts on democracy.

It has often been argued that societal issues are too complicated for laymen to be able to make sensible judgements. It is true that the collective intelligence, so much praised by Dewey, does not emerge spontaneously. It is not enough to bring people together, to allow everyone to express themselves, as on social networks, so that it automatically generates knowledge or leads to rational decision-making. If we accumulate information

without processing it, prioritizing it or criticizing it, we then arrive at a relativistic position: every opinion counts and therefore nothing is worthwhile. This leads to the bedrock of the most stupid ideas, the most ridiculous theories, even intolerable words. And that also can be found on Internet. However we learn from crowdsourcing applications that well-designed computer tools can build knowledge from imperfect contributions. For societal debate, to regulate the discussion on Internet can be obtained by orchestrating the speech acts that appear in a debate instead of applying *rules of procedure* that can be weak ot too generic in this case.

Let us see how things happen in an ordinary critical discussion. During a discussion with colleagues to solve a problem you may be led to make a proposal and develop an argument to support it. This argument is of course still weak because it is imprecise, there are implicit assumptions and some arguments should be better justified. In fact, you try as much to convince yourself as to convince your interlocutors. This is where a critical discussion takes place. You are asked to clarify some statements to make sure that we understand each other and talk about the same thing. Your interlocutors may have doubts, they can raise objections or even attempt to refute certain points. You feel compelled to support your proposal with additional or stronger arguments. You may be coerced into making concessions leading you to amend your initial proposition. But you can also be supported by other interlocutors who agree with you. In this way your argument becomes stronger and more credible. However, it may happen that you realize at some point in the discussion that you will not be able to face some strong objections. Your proposal doesn't make enough sense. At that moment you give it up: "Let's forget it, it was stupid!". And the attention get focused on other leads.

Overall, a well-regulated debate should make it possible to

- build a shared understanding of the problem in terms that everyone can understand,
- consolidate positions with precise and documented arguments, and
- eliminate proposals that do not stand up to criticism.

Consensus conferences and deliberative polling systems have shown that non-specialists can give sound opinions even on technical issues when they are adequately informed and have an opportunity to debate. Another important feature of these procedures is that professionals can also learn something from lay people. Nonetheless, even though consensus may be reached on many subjects it is not an end in itself. It is not necessarily desirable to reach a lukewarm consensus on complex issues, especially if agreement is obtained to the detriment of opponents whose opinion was discarded. Moreover the agreement obtained at a given moment may very well not be valid some time later when circumstances have changed. It is preferable for the debate to identify a set of coherent solutions that can be refined over time. Therefore, we do not perceive the citizen societal debate as a decision-making process but rather as *an ongoing and revisable construct of a shared understanding of the situation and the expression of an informed and unmanipulated opinion reflecting the diversity of points of view*. Politics is the art of dealing with disagreements, conflicts, and oppositions and it is the responsability of politicians to make the decisions.

Our approach, for the case of societal debate, is reminiscent of Dewey's theory of inquiry [55]. This image of an inquiry as a search for the truth evokes these detective series in which investigators use a blank board on which they place the various clues (photos, newspaper clippings, notes) that they try to link together in order to elicit an explanation. We're looking for what we want to prove at the same time that are constructing the proof.

In an imaginative manner: The bridge is built by crossing it. A citizen societal debate does not start from a predefined series of questions (a poll) but with a very general societal issue (how to improve our educational system ? How to reduce underemployement or inequalities ? ...). When there are irreducible antagonisms, namely those that cannot lead to consensus, it will be necessary to identify points of divergence. That is to say, we shall try to trace back the origin of the conflict: what is the divisive question? This is the question on the crest line whose answer determines which valley we are going to find our way in. We shall not try to favour specific answers to these questions as long as any of the corresponding point of view is acceptable as it survives the process of critical discussion. Rather we shall use these questions to solicit the public opinion with a poll. Such a survey can indeed give a meaningful picture of public opinion because issues are put into context. Even better: the questions are produced by the debate itself. From a practical point of view, the computer system should help to periodically build a synthesis of the debate with the identified cleavages (the poll) which are published on a web page. The visitors will be able to learn about the debate and the different proposals. They will be able to give their opinion by answering the survey. If they wish, they can also take part in the discussion, because the debate is never over.

Thus a citizen societal debate can be seen as a computer supported version of a James Fishkin's deliberative opinion poll [13]. Allowing the debate to take place on Internet make it truly inclusive by opening it up to anyone interested. Additionaly, computer tools can be effective in conducting remotely a debate for at least three reasons:

- In a written form, an argument is made explicit and therefore open to criticism.
- A speaker could mislead the audience. But if you feel uncomfortable with an opinion, you have here enough time to find more and think about the issue and formulate your criticism or observations. This asynchronism in communication can also help to alleviate the intimidation that a lay person can experience when confronted with an expert's opinion.
- There will be at least one person in the crowd of participants who will not be deceived by a misleading argument and will bring the contradiction.

Another advantage is that, as for Wikipedia, the produced information is preserved, easily shared, and it can be refined over time. These citizens' debates are not subject to the political agenda: they can be launched as soon as a sufficient number of people feel the opportunity. This avoids dithering on important issues that are not addressed by politicians because of a lack of immediate solutions. Political action is often focused on immediate action, while the most important issues are those that commit us over time. Finally, these debates can be a valuable source of information that can be used in the early stages of deliberations by providing decision-makers with a better understanding of the situation and public opinion on the subject.

3. Theoretical Foundations of Rational Discussion

In this section we give a brief introduction to some theoretical foundations of rational argumentative discourse that underpin argumentation tools.

1. Fallacies, Argumentation Schemes, and Critical Questions

> *Argumentation is a* [mainly] *verbal* [(spoken or written)], *social, and rational activity aimed at convincing a reasonable critic of the acceptability of a standpoint by putting forward a constellation of propositions justifying or refuting the proposition expressed in the standpoint* [w.r.t. a certain issue]. [103]

Since Greek antiquity and Aristotle's works, it is recognized that argumentation has three components: syllogistic logic, as an art of thinking correctly, rhetoric, as an art of speaking well, and dialectic, as an art of dialogue. In the late 19th and early 20th centuries, rhetoric has fallen into disgrace. It has been severely criticized and excluded from the field of scientific disciplines. At the same time, logic has become more and more formal by becoming a branch of mathematics and had lost its relationship with the concrete use of language. The theory of argumentation was then confined to theological or legal discussions.

Towards the end of the fifties, the argumentation studies underwent an important development, particularly with the publication of the books by Perelman and Olbrecht-Tyteca [72] and Toulmin [98]. This revival of studies on argumentation took place after the Second World War and in the context of the Cold War, where democracies felt the need to oppose political propaganda by proposing mechanisms for developing a rational democratic discourse.

It is often by observing how a system malfunctions that we can understand how it works (or should work). Charles Hamblin proposed to study the everyday argumentative discourse, as found in the mass media, advertisements, books or political campaigns, through an analysis of fallacious arguments [15]. In the Platonic view a *fallacy* is an invalid argument, but one that seems valid, introduced in order to mislead the audience. Aristotle's syllogistic logic aims precisely to find rigorous criteria to exclude fallacies from rational discourse. For that purpose an argument is considered to be valid only if it can be obtained through application of a prescribed set of formation rules. This normative approach has developed through modern formal logic that can be construe as an absolute search for truth. Indeed, a formal proof allows a transfer of acceptability from its assumptions to its conclusion: you must accept the validity of the conclusion as soon as you have conceded the assumptions.

Stephen Toulmin considered that this absolutism has in fact limited value because formal validity is only applicable to analytical arguments, which are rare in practice. We should not restrict to deductive reasoning but also accept other forms of rules to cope with inductive inference (i.e., generalization) or conductive reasoning (by evaluation the pros and cons). These rules have an imperfect transfert of acceptability from assumptions to conclusion but are useful in practice.

Many argumentation schemes used by the sophists, even if they are logically non valid, are quite acceptable in a discussion if used with caution. After all, our purpose is not to formally prove the validity of a claim but rather "*to convince a reasonable critic of the acceptability of the standpoint*".

Fallacies should rather be viewed as unreasonable uses of argumentation schemes. An argumentation scheme [108] is a stereotypical pattern of reasoning that can be evaluated through a set of critical questions. For example, if I carry out a generalization based on examples, I have to justify that these examples are representative. If a decision is denied on behalf of its negative consequences, the probability of this causal link must be assessed. For example, stating that *a young man who has used cannabis must be severely condemned, because if not, he will switch to harder drugs and commit criminal acts to finance his addiction* is a clear fallacy. On the other hand, *condemning nuclear energy on the grounds that it generates hazardous wastes, which will have to be stored in a safe place for millennia* can be a perfectly acceptable argument, even though it will probably not be sufficient to convince those in favour of nuclear energy. If I use an authoritative argument by saying "A, Nobel Prize winner in economics, asserts P", I should expect to be challenged on a number of critical issues such as "Is this interpretation of A's words correct?","A had attached his assertion to restrictive conditions which I doubt whether they are met here", or "B, who is an equally recognized expert as A in economics seems to oppose this view".

Critical questions contribute to the quality of the discussion in several ways. First, they highlight the points that need to be addressed in order to ensure the completeness of a proposition by specifying the objections that arise for any form of argument. Anyone who proposes an argument can anticipate these objections by using critical questions as a checklist. In this way it helps participants to build stronger arguments. Second, it's a way to discard misleading proposals that don't stand up to criticism. Finally, it allows the system to be proactive in suggesting ways to challenge a proposal. This helps ensuring *diversity* in the debate, which is acknowledged [93] as a crucial condition for producing a rich and complete information and/or for reaching a sound decision-making.

Walton's classification of argument schemes thus relied on an analysis of fallacies. However weak argumentations can also result from cognitive biases [67], or an insufficient consideration of alternative proposals. Some systems can also use an ad-hoc set of argumentation schemes (with their related critical questions). This is the case for *Parmenides*[1], which was a structured survey tool to gather public opinion on a proposal. Parmenides was designed to allow a government (or administration) to present its proposals in order to obtain better public acceptance but also to know about public opinion (through a survey) and gather suggestions for alternative proposals. A proposition takes the form of a description of the current situation, and recommended actions whose expected consequences are assumed to improve the situation in terms of commonly accepted values. Such a proposal can be challenged through the following set of critical questions:

- Disagree with the description of the current situation.
- Disagree with the consequences of the proposed action.
- Disagree that the desired features are part of the consequences.
- Disagree that these features promote the desired value.
- Believe the consequences can be realized by some alternative action.
- Believe the desired features can be realized through some alternative action.

[1] Developped in the frame of Katie Atkinson's PhD Thesis this system seems to be no longer maintained.

- Believe that an alternative action realizes the desired value.
- Believe the action has undesirable side effects which demote the desired value.
- Believe the action has undesirable side effects which demote some other value.
- Agree that the action should be performed, but for different reasons.
- Believe the action will preclude some more desirable action.
- Believe the action is impossible.
- Believe the circumstances or consequences as described are not possible.
- Believe the desired features cannot be realized.
- Disagree that the desired value is worth promoting.

In some circumstance one may imagine using critical questions to encourage a SWOT analysis of a suggested action: what are its Strenghts, Weaknesses, Opportunities and Threads? In this case we see that critical questions are not necessarily attacks directed toward the proposition but can be used to suggest improvements or amendments, or to reinforce it with new elements.

The system SEAS [2] proposes a template-based structured argumentation tool that allows users to author domain-specific argumentation schemes, the templates. The aim is to help non-experts to make sound reasoning by reusing such templates, viewed as transferrable descriptions of how to make sound arguments.

Pragmatic philosophers like John Dewey and Richard Rorty as well as argumentation theorists like Stephen Toulmin have developed a Darwinian approach to the debate. They believe that the selection and strengthening of arguments is done through their critical examination. Only admissible arguments stand up to criticism in a well-regulated debate. Such a regulation should provide support to both *innovation* and *selection*: Rules should proactively encourage the contribution of new elements to the debate but also evaluate and select the arguments as they develop during the critical discussion.

The pragma-dialectical approach of Van Eemeren and Grootendorst [103] follows the same line by inscribing the approach of fallacies and rationality in the perspective of a dialogue governed by rules accepted by interlocutors. It is presented as a normative pragmatics since it focuses on describing the obligations to which a speaker commits himself in his speech acts (see Appendix E).

2. Pragmatics and Organization of Debate

Pragmatics [59], as a field of linguistic, aims at studying the language from the way it is used in conversations. In particular by considering the relations of mutual understanding between a speaker and a listener and their respective committments. In this section we show how the theory of speech acts and Gricean maxims of implicature can be used in argumentation theory.

2.1. Speech Acts

Both the pragma-dialectical approach of Van Eemeren and Grootendorst and Walton's approach of logical argumentation (Appendix D) are normative descriptions of argumentation viewed as a sequence of speech acts performed by users in a conversational discourse.

[2] http://www.ai.sri.com/~seas/

The theory of speech acts, introduced by John Austin [4] and subsequently elaborated by John Searle [88], distinguishes between five categories of speech acts:

Assertive Commit the speaker to somethings being the case.

Directive Attempt to get the hearer to do something: question, order, request ...

Commisive Commit the speaker to some future course of action: vows, promise, commitment...

Expressive Express a psychological state about a state of affairs: apologizing, praising ...

Declarative Bring about the correspondence between the propositional content of the speech act and reality: pronouncing a couple married, a session to be open ...

Each speech act has a *force* (degree) and comes with *felicity conditions* to be satisfied for the speech act to achieve its intended effects.

From the Computer Science point of view, pragmatics had a role in the design of computer tools for the coordination of work after Winograd and Flores [111]. Their work on the *Coordinator* model has been pursued in the context of *Language/Action Perspective* [38, 109] where it is argued that language is not only used for exchanging information but also to perform actions (as in promises, orders, requests, and declarations). The papers [53, 46] give also a survey of applications of speech act theory for argumentation.

As concerns the role of *speech acts* for the specific case of conducting deliberative assemblies, Appendix B lists some specific *performative prefixes* extracted from the Robert's rules of order [82, 83] that could be useful while designing programs for the coordination of debate. As mentioned above, speech acts can *succeed* or not in dependence on some *felicity conditions*. Austin classifies the *felicity conditions* in three categories ([59], page 229):

A (i) There must be a conventional procedure having a conventional effect (ii) The circumstances and persons must be appropriate, as specified in the procedure

B The procedure must be executed (i) correctly and (ii) completely

C Often, (i) the persons must have the requisite thoughts, feelings and intentions, as specified in the procedure, and (ii) if consequent conduct is specified, then the relevant parties must so do

The case for conducting debates in deliberative assemblies is an example of speech acts were item A above is codified in a formal procedure and item B is the subject of continuous check for the debate being *in order* or *out of order*.

The specific speech acts used for the coordination of deliberative assemblies are sometimes called *procedural speech acts* as in [76]. They have a specific character in the codification of their *performative prefixes*. A *performative prefix* can be seen as a *performative phrase* minus an argument: the complement of the performative verb.

2.2. Gricean Maxims of Implicature

If we ask some colleague whether she wants to join us for a coffee break and she answers "I should leave early and I have some work to finish before" we understand that she has no time for a coffee break and thus decline our invitation. Grice [42] termed *implicature* the information that is conveyed by a speaker even if it is not directly formulated. Grice used "implicate" rather than "imply" to stress that this information is not necessarily logically

implied by the sentence but rather inferred by the listener according to the context of the sentence in the conversation. In order for this reconstruction to be successful the participants in the conversation should obey the following maxims of implicature:

Quantity: Make your contribution as informative as is required for the purpose of the conversation but no no more informative as needed.

Quality: The contribution should be true and sincere: you should believe your statement to be true and have some backing evidence.

Relation: The contribution should be relevant.

Manner: Be perspicuous, avoid obscurity and ambiguity, be brief and orderly.

Although Gricean maxims are assumptions that listeners make about how speakers talk in order to interpret correctly the meaning of their utterances, they can also be used as prescriptions about how to speak in order to communicate successfully . Thus, Gricean maxims can be used to formulate critical questions that challenge a statement against one of the above criteria (quantity, quality, relation, and manner). Unlike other critical questions that depend on the argumentation scheme, the critical questions associated with the Gricean maxims of implicature apply universally to any statement.

3. Logics of Discourse and Argumentation

3.1. Informal logic and Defeasible Reasoning

Epistemologist John Pollock [74] and the promoters of informal logic have put forward the notion of *defeasible argument*. An argument is defeasible when its assumptions support the conclusion but do not entail it. Defeasible resoning should be contrasted with *deductive reasoning* for which it is impossible for the conclusion to be false when the assumptions hold true. The key rule of deductive reasoning is *modus ponens* that allows to deduce B from A and $A \Rightarrow B$.

By contrast, using implication $A \Rightarrow B$ for a transfert of acceptibility in the reverse direction (for inferring A from B) is not logically valid but may be used for approximate reasoning if we consider that implication $A \Rightarrow B$ states that A is a potential/probable cause for B. Therefore, if we seek to establish B, it is reasonable to try establishing A as an intermediate result (a lemma). Such kind of reasoning is also called *inductive reasoning* and the inductive steps are usually given a measure of confidence. For instance John Pollock has related inductive reasoning (at least in the case of generalization) to the so-called *nomic* probabilities [75].

Rules for defeasible reasoning can also take the form of deductive rules with exceptions as for example “a bird, if not a penguin, flies” which lead some researchers in Artificial Intelligence to study *non-monotonic logics*. It may aslo take the form of *conductive reasonning* that combine arguments for or against a conclusion.

In [74] John Pollock introduced different classes of defeaters that can invalidate application of a rule. A *rebutting defeater* contradicts the claim (conclusion) of an argument step. An *undercutting defeater* doubts that the claim follows from the subclaims and evidence (for example, if there is some missing or implicit assumption that represents a ’gap’). Finally an *undermining defeater* doubts some of the evidence or subclaims used in an argument.

Defeaters for a rule may thus be associated with critical questions whose exhaustive examination can guarantee the conclusion above some threshold of credibility. This is the notion of *indefeasible argument* put forward by John Rushby [84]: “*For justification to be compelling, the argument must be indefeasible, meaning that we have so thoroughly*

considered everything that can go wrong (i.e., hazards to the system and defeaters to the argument) that there is no new information that could change our assessment". [3]

3.2. Dialogue Games and Dialogical Logic

Since Lorenzen and Lorenz's pioneering work on dialogical logic [62] and Jaakko Hintikka's *Information-Seeking Dialogues* [47, 52], modern logic has been reconnected with dialectic. Many works in logic, artificial intelligence (expert systems and multi-agent systems), and theoretical computer science put now emphasis on game theoretic techniques and the modelling of interactions in a dialogic context.

Dialectical systems were introduced by Charles Hamblin [15, 16] in order to make arguments appear in the form of dialogues in which two parties engage in an exchange of orderly questions and replies. In this model, that was further refined by Erik Krabbe and Douglas Walton [106], a particular emphasis was placed on the commitments of the actors involved in the dialogue and the mechanisms that can be invoked by a participant to retract some of his or her prior commitments. Such a retraction when it is allowed should undergo some modifications on the current state of the system to recover a coherent situation. These so-called *stability adjustments* are reminiscent to the logic of theory change and belief revision [1, 43, 44].

Hamblin made a distinction between the descriptive study of dialogue and the formal study of dialogue. The descriptive study of dialogue is used mainly for the reconstruction of actual conversational exchanges in ordinary conversations or in specific contexts (parliamentary debates, legal examinations, expert's discussions). Formal study is concerned by simpler and more precise set of rules expressing how a critical discussion should ideally be conducted. Due to its more formal and normative aspects, this approach is more suitable for the design of a computer system aimed at controlling the language acts performed by participants in a debate.

Barthe and Krabbe [6] enriched Hamblin'model by making a distinction between *claims* and *concessions* as different types of commitments. A speaker is committed to justify one of his prior claims if this claim is challenged by an opponent, whereas he or she is not committed to a concession that he or she does not necessarily support but uses as a working hypothesis for the sake of argument. For instance for challenging an implication $A \Rightarrow B$ an interlocutor may concede A and challenge B. This amounts to challenging the other party to justify that B holds true under the working hypothesis that A is true.

There are various types of dialogues inspired from dialogical logic. All of these take the form of a sequence of questions and replies, or attacks and defenses, where each side takes a turn to make a 'move', which is a complex speech act (sequence of locutions) advanced by a participant at a particular point in the dialogue. The purpose of each participant is to prove his or her own assertions from assumptions that are initially granted or conceded during the debate by the other party . This presupposes that we know how to identify from the outset the proposition to be established. This is indeed the case in a persuasion dialogue but not so in other cases of dialogues for which, whether it is a negotiation or a process of eliciting a hypothesis or seeking an explanation (for example in a panel discussion), we must, as Dewey points out in his logic of the inquiry [55], discover the explanation sought at the same time as we establish its correctness. In addition, this type of dialogue gives precedence to the confrontation of opinions over cooperation between participants. Yet the

[3] One may consider dialogical systems where a dialogue may contain some sub-dialogue based on inductive reasoning if we do not return to the main dialogue until the sub-dialogue has reached an indefeasible conclusion (a form of atomicity that allows us to avoid non-monotonic logic).

cooperative aspect of dialogues is often critical, even if they include persuasion phases (in the form of sub-dialogues).

3.3. Refutations and bi-Intuitionistic Logic

Another interpretation of inductive reasoning, viewed as a dual to deductive reasoning, is given by the *modus tollens*: from $A \Rightarrow B$ and $\neg B$ one can deduce $\neg A$. In this case implication $A \Rightarrow B$ is used to transfer *refutability* (rather that provability) from B to A. In classical logic the two viewpoints are equivalent since proving an assertion is equivalent to refuting its negation. This is no longer true in intuitionistic logic where negation is no longer an involution: an assertion that is not refutable is not necessarily provable.

We thus have a distinct *dual intuitionistic logic* viewed as a logic of hypotheses and their refutability [40, 101] that mirrors intuitionistic logic, the logic of assertions and provability. Intuitionism, in general, cannot deal constructively with negation. Thus, intuitionistic logic and dual intuitionistic logic dealing respectively with provability of assertions and refutability of hypotheses can be considered separately and then the negation (of classical logic) is replaced by a duality between assertions and hypotheses reflecting the coherence of the logic: a provable assertion cannot be refuted and a refuted assertion cannot be proved. This results in the so-called bi-intuitionistic logic that was initially investigated by Cecylia Rauszer [78, 79, 80]. A 'polarized' version of bi-intuitionism was given in [23] where assertions and hypotheses are explicitely represented as distinct entities.

Karl Popper and Imre Lakatos have also stressed the key role of refutations in the epistemology of sciences. In his book "Proofs and Refutations" [58, 39] Imre Lakatos distinguishes deductive systems, called *euclidian systems*, from inductive systems. The axioms of an euclidian system are logically true statements from which one can derive conclusive evidence of an assertion by deductions, namely by constructing a proof of the assertion (a theorem) from the axioms taken as assumptions. The axioms, whose validity is taken for granted, represent the expert's knowledge. These are the statements on which the experts agree when they engage in a scientific discussion and which express their consensus on the subject.

However scientific theories evolve through a trial-and-errors process. Speculatively, we make hypotheses that we try to prove. But we usually combine deductive and inductive reasonings: we guess some useful intermediate results (lemmas) of which we know that the sought result follows by deduction, and then try to establish the validity of these lemmas. As long as the process is not completed the global hypothesis or one of its lemmas can still be refuted.

Refutations proceeds inductively from empirical assertions, or more precisely from the knowledge that some basic assertions are false due to the fact that they contradict the empirical data. A statement, when refuted, should either be left out or amended. For instance we may amend a statement of the form $\forall x\ (A(x) \Rightarrow B(x))$, "all A-objects satisfy property B", by refining the definition of A in order to exclude particular cases that were used to refute the formula.

We note that, as in Dewey's Logic of Inquiry, the elaboration of a theorem and the construction of its proof are deeply intertwined. This type of dialogue gives precedence to induction over deduction in accordance with Imre Lakatos' vision that mathematical activity is essentially inductive in contrast to the resulting mathematical treatises, which are reconstructed in a purely deductive manner. Inductive reasoning conforms to the Darwinian approach to the inquiry put forward by pragmatic philosophers, which is based on the interactions between creative aspects (speculative research by spelling out hypotheses) and

selection processes (rebuttal by constructing counter-examples).

Similarly Lorenz and Lorenzen's Dialogic Logic put emphasis on inductive reasoning. Indeed the proponent (who try to prove a statement) proceeds in backward direction. For instance he would defend his assertion that $A \Rightarrow B$ from the attack of the opponent conceding A by asserting B which in turn can be attacked by the opponent. In constructing the proof the proponent is not allowed to concede a proposition variable because it would amount to make an hypothesis on the context when he must prove his assertion universally (such a move could be accepted only as a form of concession). On the contrary the opponent can concede a propositional variable and this should be construed as a step toward the construction of a counter-example. The proponent nonetheless can use a propositional variable previously conceded by the opponent in order to defend his assertion by rebutting the counter-example under construction.

3.4. Challenges for a Logical Formalisation in Argumentation

Dialogical logic is a promising approach in that it forms the basis for the dialogue games for the conduct of debates in terms of speech acts, as illustrated in the works of Walton and Krabbe and in the pragma-dialectic of Van Eemeren and Grootendorst. Nevertheless, there are still some ingredients missing to make the link with bi-intuitionist logic and evolutionary epistemology.

The missing ingredient in Dialogic Logic are mechanisms for making concessions when the proponent may wish to amend (weaken) his or her assertion when he/she does not see how to face the objections of the opponent.

On the other side, emphasis should be placed in the dialogue games on the collaborative aspect to the detriment of the conflictual aspect. The *commitments* of the various participants will continue to play an important role in the subdialogues of types *persuasion*, *inquiry* or *deliberation*. But in the main dialogue, which is of the *discovery* type, it will be more useful to focus on the *consensus under development*; that is, on the propositions that, at some point, are collectively accepted as established or refuted.

A dialogue in such an enriched dialogic logic would provide conditional assertions of the form $\Gamma \vdash A$ where A can be deductively proved from assumptions in Γ and this set Γ cannot be refuted (it is an indefeasible set of hypotheses). For instance starting from expert knowledge (in the form of axioms) and a set of empirical assertions (associated with a situation to analyse) an expert panel could produce several such results $\Gamma_i \vdash A_i$ providing sound (even though not irrefutable) explanations of the situation, where soundness means that assertions are proved from indefeasible assumptions (for example an assumption that cannot be refuted on the grounds of the available information). One could nonetheless find incompatible explanations as some hypotheses Γ_i and Γ_j might be jointly inconsistent.

4. Computer Tools for the Coordination of Debate

The subject of coordination of debate, either in presence or remotely, is tackeld with distinct techniques by the communities of *Artificial Intelligence* and *Human-Computer Interface* as explained in section 1. Both these communities are active in the field since more than forty years and a number of tools and prototypes have been produced. As a rough estimate, by adding the tools and prototypes quoted in [8] and [97], a hundred of items was easily reached already in the years 2007–2009. We cannot report here on such a range of techniques and types of debate modelled.

In this section, we present some tools or prototypes closer to the Human-Computer Interface community since we put a stress on the process along which the debate develops. Within the Human-Computer Interaction community, the tools for coordination of debate are referred to as *online deliberation* tools also in case the *"online"* component of the tool is only part of a structured process including meetings *in presence*. In spite of its use by the Human-Computer Interaction community, the term *online deliberation* cannot be associated to a unique branch of Computer Science since it contains subjects treated by several branches, Artificial Intelligence among these.

The areas covered by *online deliberation* tools are well summarized by Seeta Peña Gangadharan in [97] where, in the *Epilogue*, she lists four fields of Computer Science directly related to *online deliberation*: 1) design of *intelligent agents*, in case autonomous decisions without the presence of humans are intended as a kind of deliberation; 2) group *collaboration software*, when deliberation is intended as cooperation on decision-making; 3) *computer supported cooperative work* in all cases of cooperation in doing something, as for cooperative authoring of documents; 4) *group learning systems*, intended as tools for getting consensus by sharing knowledge.

Individual components of an *online deliberation* tool can be based on research done in these fields and, consequently, several computer tools can be listed as components of tools for *online deliberation*; for example *virtual meeting spaces*, *collaborative writing*, *visualization of argumentation*, *preference aggregation* and *deliberating agents*.

We can not deal in this section with all the technical aspects of such components, so we restrict the scope to few specific computer tools as examples of the development of the field. The tools are chosen in relation to their treatment of a debate as a process eventually ordered by rules of procedure. The sections below are consequently structured as are the entries in table 1.2 where the rules of procedure adopted range from very shallow ones for *citizen's debate* to very tight ones for *parliamentary debate* with intermediate levels for *deliberative polls* and *coordination of political parties*.

1. Citizen's Debate

In this section, we describe briefly a computer program related to the category *citizen's debate*: the *Debatepedia* [50]. *Debatepedia* is an initiative of the *International Debate Education Association (IDEA)* and of the *Georgetown University*. Structured graphically as the *Wikipedia*, the *Debatepedia* follows the collective authoring process called *wiki* for managing its contents. The assumptions behind *Debatepedia* are (quoting form the web

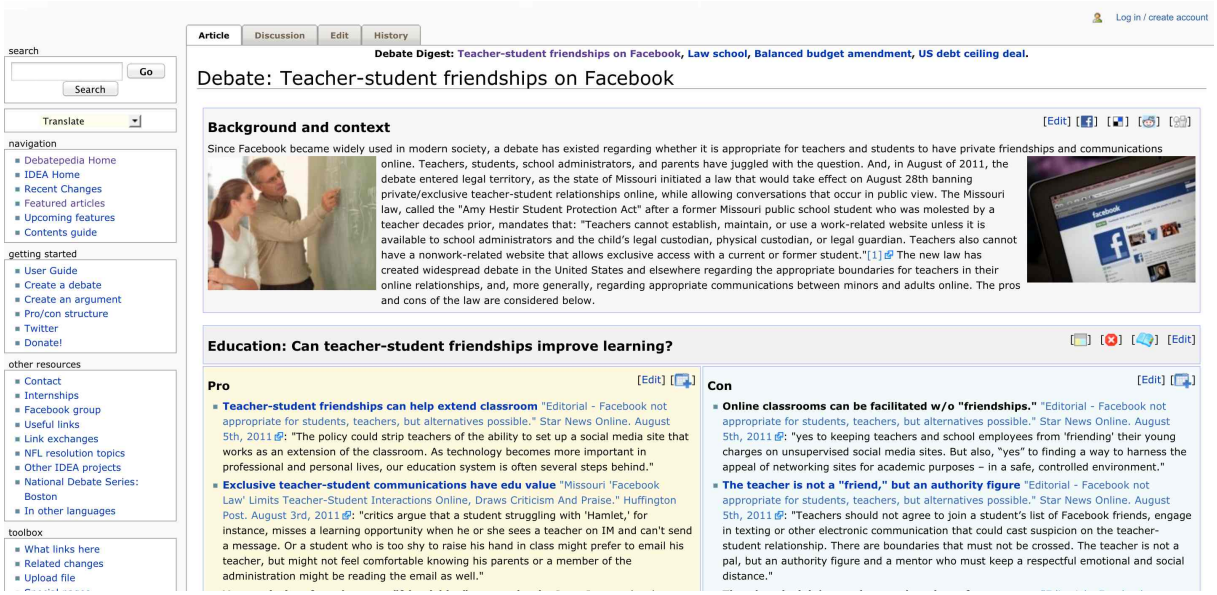

Figure 4.1.: Debatepedia. Debate on teacher-student friendship on Facebook [50].

site): *(1) That unique arguments can be isolated and presented in an encyclopedia form. (2) That a wiki community can come to a consensus on rules designed to help regulate the presentation of these unique arguments. (3) That split-screen/question/subquestion "logic tree" method is ideal for framing debates, and that it is compatible with "wiki" technology.*

The objective of *Debatepedia* is (quoting again form the web site):*[. . .] to document or outline every pro and con argument and all supporting quotations from leaders, authors, experts, columnists, op-ed writers, etc. You can also "make" original arguments and counter-arguments. We encourage this. But, remember, the idea is to "document" or "outline" lines of argumentation, not to "express" your "personal opinion" or personal anecdotal stories or research.* The *editing policies* of Debatepedia can be summarized as follows: 1) accomplish the general aim at clarifying public debates in the form of an encyclopedia with clear arguments and quotations; 2) a debate and its supporting arguments and quotations should be presented in a fair and balanced way; 3) all facts and references should be cited in an appropriate way; 4) arguments should be logically consistent and valid. The *editing policies* of Debatepedia, can be compared with the ones of *Wikipedia* [41]. Tools very similar to Debatepedia are *Debate* [37] and *Debatewise* [64]. In the category *citizen's debate*, we can quote other software tools without going here into details: *Deme* [24], developed at Center for Deliberative Democracy at the Stanford University and used as a component in more formal *deliberative opinion polls* processes (see section 2 below); *Wikidrama* [86], a project that tries to simplify the process of debate by using *drama characters* associated to the different opinions and the *Public Sphere Project*[87]. This last project uses to some extent the *Robert's Rules of Order* and will be described in some more detail in section 4 below.

2. Deliberative Opinion Poll and Petitions

In this section, we describe two techniques for gathering the citizen's opinion: *deliberative opinion poll* and *petition process*.

The *deliberative opinion poll* is a structured process for gathering citizen's opinion on either general subjects or specific policy proposals. The process can be organized in several phases that include both discussion on-line and in presence. The organiser of the process

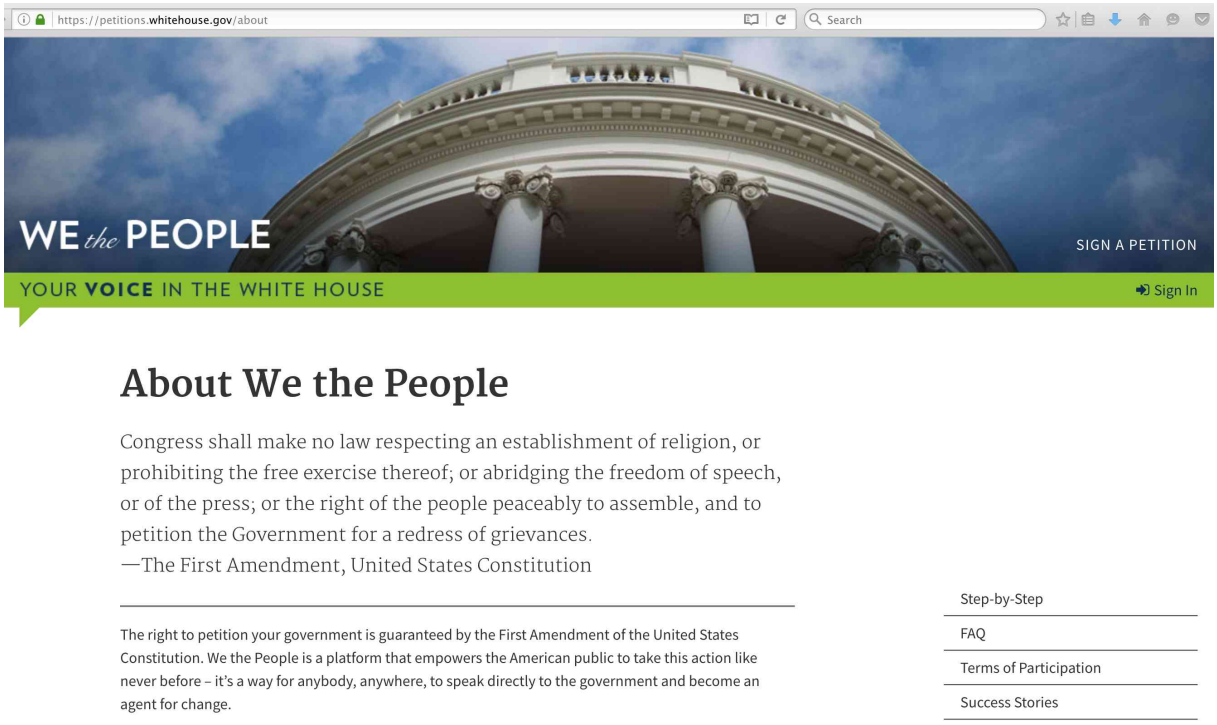

Figure 4.2.: We the People. Petition tool by the USA government [102].

is normally a government body aiming at collecting the citizen's opinion as a preliminary phase to a formal debate in parliament. The typical character of this kind of public deliberation is in the group of participants, since it is a representative sample of the citizens chosen by the coordinator of the process; the participation is not open to everybody. A further caracter is in the participation of *experts* at some point during the development of the debate. So, the sample of citizens participating in this type of poll is asked to read reports or attend to expert's presentations on the subject under debate. The eventual change in the opinion of the sample during the discussion and after the expert's presentations is recorded. The overall exercise has a limited duration, so the debate should reach a conclusion, or at least a synthesis of the various positions. What is felt as important is to track the different positions and their evolution in time during the whole exercise. While this technique is known since a long time, it obtained wider knowledge in the field of *online deliberation* after its use by the *Center for Deliberative Democracy* at Stanford University [13]. This research center makes available a set of tools, based on *Deme*[24], for organizing opinion polls. A good report on the use of such procedure in the project *Rahvakogu* started in Estonia in 2013 can be found in [63].

The *petition process*, while distinct from the *deliberative opinion poll* above, shares with it the character of being a preliminary phase to a subsequent formal debate or used as input for taking an informed decision by a governmental body. Moreover, some legislations foresee the possibility to propose a new law through a petition by lay citizens, once a threshold of citizens supporting it is reached. Computer programs for the organization of the *petition process* normally support an existing legal procedure. Among the functions provided by these programs, there is the possibility to coordinate the writing of the text of the petition via mechanisms of distributed authoring, management of amendments and vote on the individual parts of the text. Moreover, when the petition becomes a proposal for a further debate at parliamentary level, the record of the debate hold during the preparation of the petition is useful information for the members of the parliament in favour or against the proposal itself. In a *petition process*, participant's identities are known. Anonymous partici-

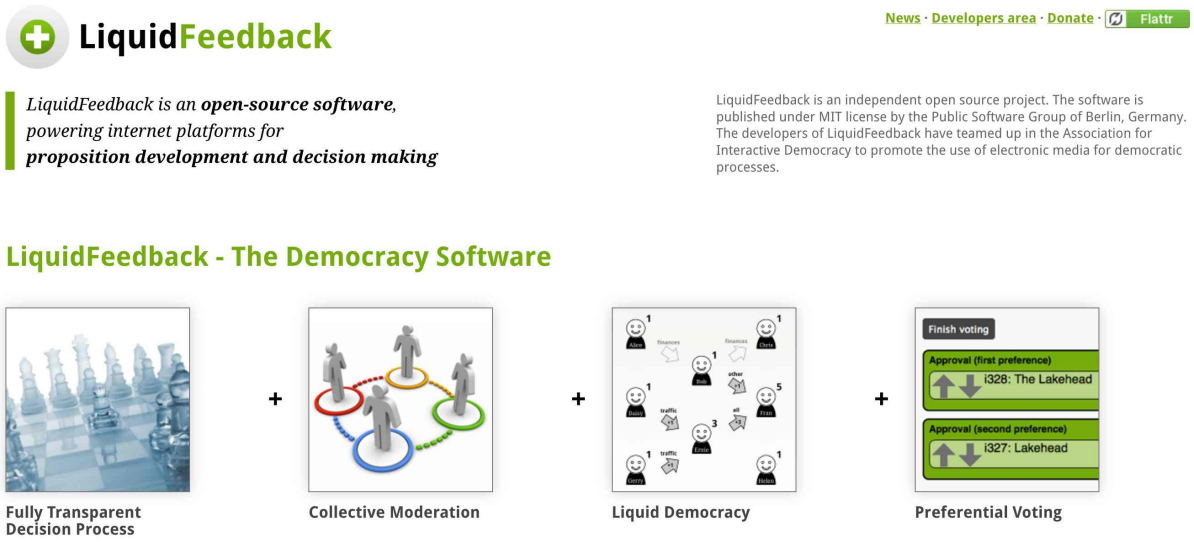

Figure 4.3.: Home page of the *Liquid Feedback* application [7].

pation is normally not allowed and the final vote of the participants in the *petition process* in favour of the presentation of the proposal as a citizen's initiative to the parliament contributes automatically to reaching the number of citizen's signatures needed for passing the threshold. A report on some *petition processes* adopted in Estonia, Latvia and Finland can be found in [63]. We stress the fact that, as said above, the *petition processes* are directly related to the legislation of the states in wich they are used. A simpler example of a petition tool used by the USA government is *We the People* [102] (see figure 4.2). This system helps the American citizens in gathering the signatures and addressing a petition to the government in agreement to the first amendment of the Constitution. These tools are distinct from more generic tools for managing petitions, like *Avaaz* [81]. *Avaaz* can be considered an Internet coordination tool for political activism with worldwide participation.

3. Coordination of Political Parties

The coordination of a political party is an important case for the realization of computer programs for conducting debates, vote and deliberate in an asynchronous and remote way. This kind of *platforms* are used by relatively new political parties like the *Piraten Partei* in Germany, the *Movimento 5 stelle* in Italy, the *Partido de Internet* in Spain and the *Partido de la Red* in Argentina.

Programs in this category are *LiquidFeedback*[7] and *Adhocracy*[60], both originally designed by a community of "hackers" active in Berlin at the beginning of years 2000. The *Partido de la Red* uses as well a tool similar to *LiquidFeedback* called *DemocracyOS*[25]. The *Partido de Internet* developed its own program, called *nVotes* [69]. Today, *LiquidFeedback* is promoted by the company *Interaktive Demokratie e.V.* while *Adhocracy* is promoted by the company *Liquid Democracy e.V.*. In both cases, the companies propose their respective computer programs as general tools for the organization of *decision making* in companies in addition to their original aim at being coordination tools for political parties. A similar commercial proposal is made by *nVotes*; *nVotes* is today a software company distinct from the political party that originated it. The common aspect for these tools is the use of a voting mechanism of *transitive delegation*: participants can *delegate* other participants to vote for them on a specific subject and delegated votes can be cumulated. In this way, an individual vote can result in as many votes as the sum of the delegations received.

Delegation and withdrawal of delegation are dynamically managed in "real-time" by the software *platform*. Among the tools used for decision making or coordination of political parties that do not use *transitive delegation* mechanism, *loomio* [61] and *Rousseau* [3] can be mentioned. *Loomio* seems designed for small communities and uses a *dot-voting* [54] mechanism. The "*Rousseau platform*" is gaining importance in Italy for its use by the "*Movimento 5 Stelle*" political party. An explanation of the mechanisms of vote in the *Rousseau platform* and a discussion on general concerns raised by software tools designed as *Rousseau* is can be found in [26].

4. Parliamentary Procedure and Robert's Rules of Order

Rules for organizing debates exist ever since and, from national parliaments to small committees, these rules help in keeping the debate ordered and effective. Research on software tools for deliberative assemblies adopting *rules of procedure* started in the nineties when the *Zeno* discussion forum, developed at the GMD in Bonn, was augmented with a set of rules for the organization of debate [76]. These rules, taken from the Henry Robert's rules of order manual [82], "*assist the human mediator in maintaining order at the forum, and in giving advice to the users of the forum on their options, rights and obligations in the discussion*". A simplified implementation of the Robert's rules of order for delibrative assemblies can today be found in Internet discussion forums like *e-Liberation* [87]. From the first prototype, Zeno evolved in several further applications; a survey can be found in [104]. See also [91] for another software application of rules of procedure in parliaments. We remark that the original rules of order by Henry Robert should be applied to a specific type of assembly, the *deliberative assembly*; the adaptation of these rules for conducting *on-line* debates is still subject of controversy. According to [83]:

"*A deliberative assembly [. . .] has the following distinguishing characteristics: It is a group of people, having or assuming freedom to act in concert, meeting to determine, in full and free discussion, courses of action to be taken in the name of the entire group. The group meets in a single room or area or under equivalent conditions of opportunity for simultaneous aural communication among all participants. A group that attempts to conduct the deliberative process in writing — such as by postal mail, electronic mail (e-mail), or facsimile transmission (fax) — does not constitute a* deliberative assembly. *When making decisions by such means, many situations unprecedented in parliamentary law will arise, and many of its rules and customs are no more applicable.* "

So, research on computer tools using *rules of procedure* follows two basic ideas: in the first case, the *rules of procedure* are adapted to on-line deliberation as in the original *Zeno* discussion forum or in *eliberate*; in the second case, it is assumed that the debate is conducted in presence of the participants. Tools in this latter case are designed for helping the coordinator of the debate to keep *in order* the discussion process. This is the case for two examples: the *Parliamentary Procedure Helper* and *Bungeni* reported below.

4.1. Parliamentary Procedure Helper

The *Parliamentary procedure helper*, described in [97] and available at `www.sourceforge.net/projects/parliament`, is based on the formalization given by Henry Prakken [76] of some of the Robert's *Rules of Order* [82, 83]. The *parliamentary procedure helper* is a small project developed mainly by students. Nevertheless, it is a good example of tools supporting deliberation processes in presence. The main active user of the *Parliamentary procedure helper* is the secretary of the meeting. The program is composed by an active part displayed onto the secretary's monitor and visible by the chair of the meeting and by a

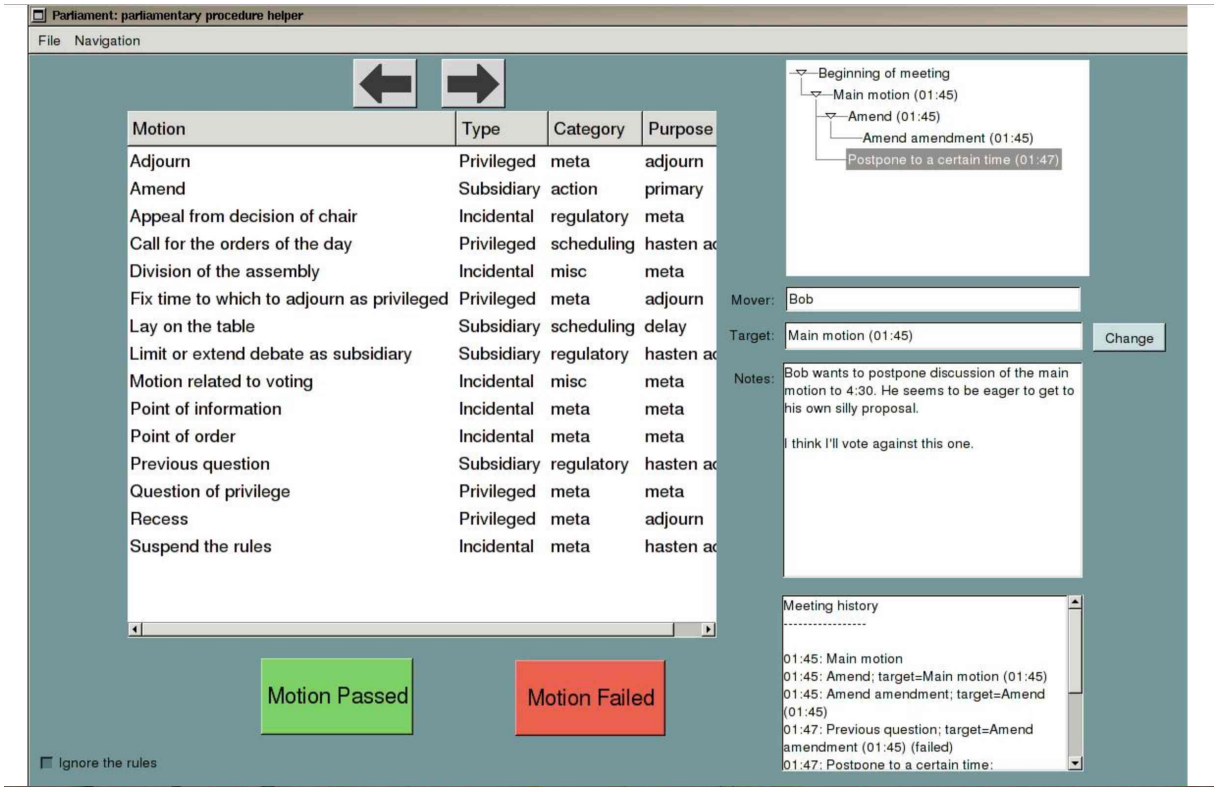

Figure 4.4.: The parliament procedure helper [92].

passive component displayed onto a big screen visible by all the participants in the meeting. The active component keeps track of the *motions* in order and organize them in the various categories foreseen by the rules. The passive component displays to the participants in the meeting the current status of the debate. Moreover, the active component allows for managing exceptions to the rules and produces a record of the meeting from which the *minutes* can be produced. This record of the work of the assembly is the intended as the basis for future software components, for example for the collaborative editing of the minutes.

4.2. Bungeni

Bungeni is a complete web suite of programs based on open software platforms like Plone and Postgres SQL, languages like Python and Java and open markup standards like *Akoma Ntoso* (see section 5). This project is part of the *Africa i-Parliament Action Plan* of the United Nations and has been funded by the Italian Development Cooperation (see [95], p. 93). It was developed in collaboration with eight national parliaments in Africa: Angola, Cameroon, Ghana, Kenya, Mozambique, Rwanda, Tanzania and Uganda. The original Bungeni web site, [99], is accessible while writing this report only through the Internet Archive[2], while the project description and code are still available at [10] and [11]. From the description of the project:

> *Bungeni aims to increase the efficiency of parliamentary activities and make Parliaments more open and accessible to citizens – virtually allowing them 'inside the Parliament' or Bungeni, the Kiswahili word for 'inside the Parliament'. Bungeni deals with the growing and challenging demands of increasing the efficiency of parliamentary activities and at the same time enabling Parliaments become more open to the citizens to foster accessibility, transparency and accountability of parliamentary activi-*

Figure 4.5.: The Bungeni project web page in 2013 [99], accessed through the Internet Archive [2].

ties. Underneath a browser driven user friendly interface - Bungeni supports advanced parliamentary workflows, and allows them to be customized for different parliamentary scenarios.

Bungeni is composed by three main modules called *Portal*, *MembersSpace* and *Workspace*. The *Portal* is the interface between the parliamentary works and the citizens. It displays the activities of the parliament and allows to the citizens to track items, post comments and suggest amendments. The *MembersSpace* is the interface between the individual members of the parliament and the citizens. Each member of the parliament can use this space for publishing news, comments and asking the opinion of the citizens on specific subjects. The *Workspace* is the module dedicated to the parliament staff, to the general secretariat, to the chairs and clerks of the committees and to members of the parliament. This module organizes the production of the parliamentary documents by keeping *in order* the flow of work in the organization of the debate and of the works of the individual committees. While the set of rules used adopted by Bungeni resembles Robert's ones, this is not explicitly written in the documentation. The *Bungeni development team* has apparently ceased to work at the project in 2016. Nevertheless, the source code and a Debian distribution are still available, in the 2013 and 2016 versions [10, 11]. The *Bungeni* "brand" has been recently taken by an Indian company [9] selling computer tools for legal, parliamentary and bibliographic services based on the XML markup language *Akoma Ntoso* described in section 5 below.

5. Documents and coordination of debate

The aim of this section is at discussing the role *documents* can have during a debate as points of *coordination* of the debate itself. We have already presented, in section 2, the pragmatic aspects and, respectively, in section 3 the logical aspects of discourse in debates. Here we deal with a more practical aspect of coordination of debate through the documents involved in it. We consider whole documents and not individual phrases or utterances composing an argumentation scheme and reflect on the role these documents can have in the design of a coordination system.

Both in case a debate is conducted in presence or remotely, documents have a role in ordering it. The simplest example is, following Robert's rules [83], pp. 353, 371 the approval

of the minutes of the previous meeting and the agenda for the present meeting during a debate session. In this case, the documents *minutes* and *agenda* have the double role of being documents produced during the debate and being associated to specific *events*. The minutes are associated to the first formal act of a debate, the agenda is associated to the formal adoption of an order for the continuation of the debate. A more complex case can be in the relation between debated points to documents in favour or against a motion; or in the adoption of reports by sub-committees. A still more complex case can be the one of legal texts authored or modified collectively during the debate. In this case, any *event* of change in the present document can affect the whole legal system, triggering in this way a chain of other *events* of change in other documents.

The relation between *order* of a debate and documents involved in the debate itself can be represented by specific points in the *causal chain* in which a debate unfolds. By considering again the simple example in [83], pp. 353, 371 it would be *out of order* to vote for the adoption of the agenda before to vote for the approval of the minutes of the previous debate. *Minutes* and *agenda* are both documents and *points of coordination* in the debate directly related to the *order of business* adopted. In the second example, the documents considered are not directly in relation with the causal chain ordering the debate. Nevertheless, they should be recorded as associated to specific points in the debate. In the third example the relation is between points in the debate and other debates and other collections of documents.

The relations between the flow of a debate and the documents involved in it can be represented by assigning specific *tags* to the documents, *tags* coming from a classification system. *Ontologies* or *thesauri* are the traditional classification systems used for this task.

The *classification* in categories of legal documents is well known in library science, and classification systems for legal corpora exist ever since. Examples are the *Eurovoc* thesaurus for the European legislation [70] or *Moy's classification and thesaurus for legal materials* [68]. The following excerpt from Eurovoc shows how the legal documents, possibly involved in a public debate, could be structured. In this example, RT is for *Related Term* with, in square brackets, the Eurovoc code of the related term. NT is for *Narrower Term*, indicating the hierarchical structure.

[1026] Sources and Branches of the Law
[...]
Source of Law
- RT EU act [1011]
- RT European treaties [1011]
- RT international agreement [0806]
- NT1 case-law
  - RT case law (EU) [1011]
  - RT legal science [1206]

[...]
- NT1 legislation
  - RT legislative power [0406]
  - RT legislative procedure [0426]
  - NT2 established right
    - RT labour law [4426]

[...]
  - NT2 local legislation
- NT1 self-regulation
  - RT open method of coordination [1011]

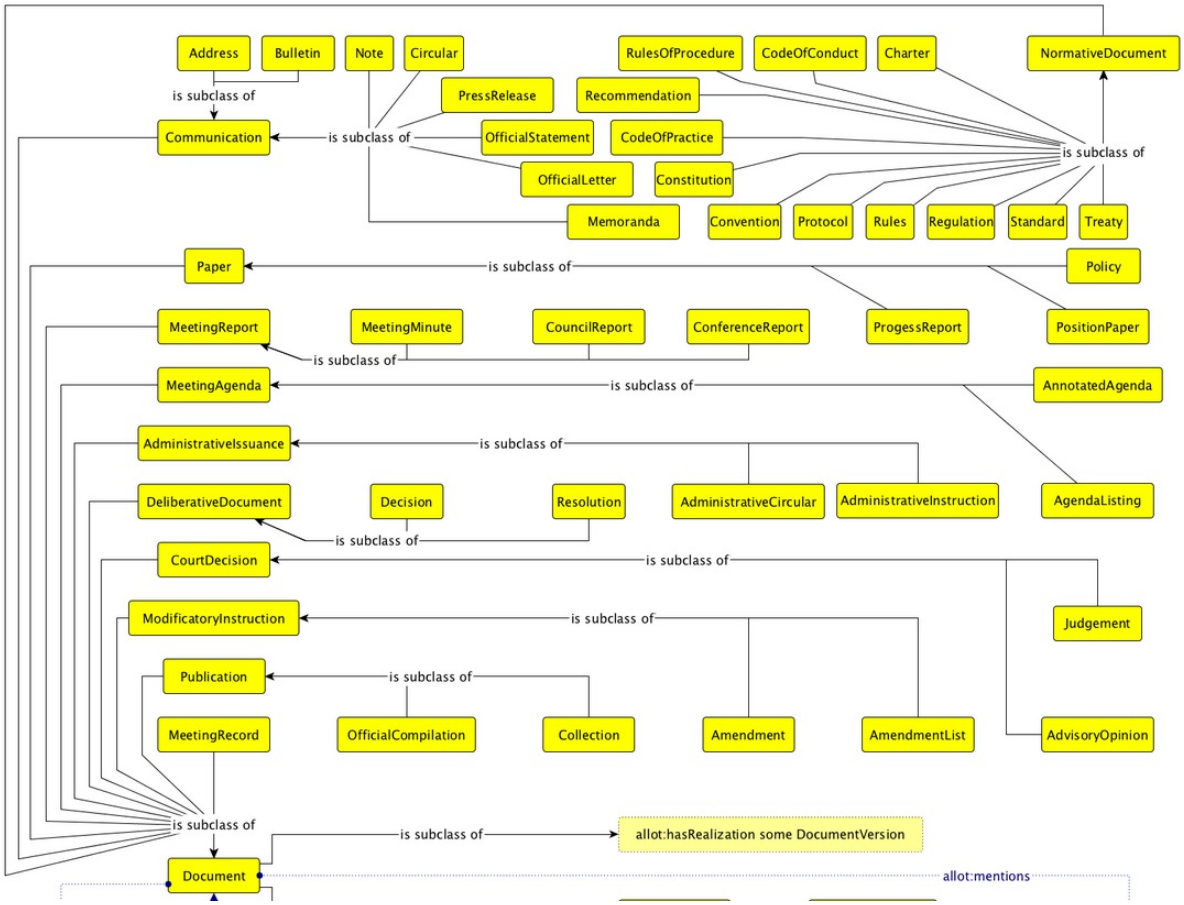

Figure 4.6.: Excerpt from the United Nations System Document Ontology

RT standard [6411]
[...]

The need for more specific classifications, apt to ordering wider collections of documents in a legal database, has led to the construction of classification systems with finer divisions and specific relational structures. As an example, we consider briefly the *United Nations System Document Ontology — UNDO* — with reference to [73] and [100] for a complete presentation of the structure and construction of UNDO. As an example of hierarchical organization in UNDO, with reference to Figure 4.6, the category *meeting report* is further divided in *meeting minute*, *conference report* and *council report*, while *meeting agenda* is further divided in *annotated agenda* and *agenda listing*. All are subclasses of *document*. These hierarchical relations are indicated in thesauri like Eurovoc as *Narrower/Broader Term*. UNDO is rich in other types of relations if compared with EUROVOC. These relations can be used by some *inference engine* for finding the net of relations in which a document is placed and its properties.

The relations between categories or terms in an ontology reflect implicitly some assumptions made on the collection of documents. A different view in respect to UNDO on the category *agenda* is present, for example, in [83], p. 353, where the order of a session of debate is *composed by* six parts: *1) reading and approval of the minutes; 2) reports of officers, boards and standing committees; 3) reports of special [...] committees; 4) special orders; 5) unfinished business and general orders; 6) new business.* If we consider this order of a session as a kind of generic format for an *agenda*, the relation *composed by* used here has a meaning distinct from the hierarchical relation *is subclass of* used in UNDO

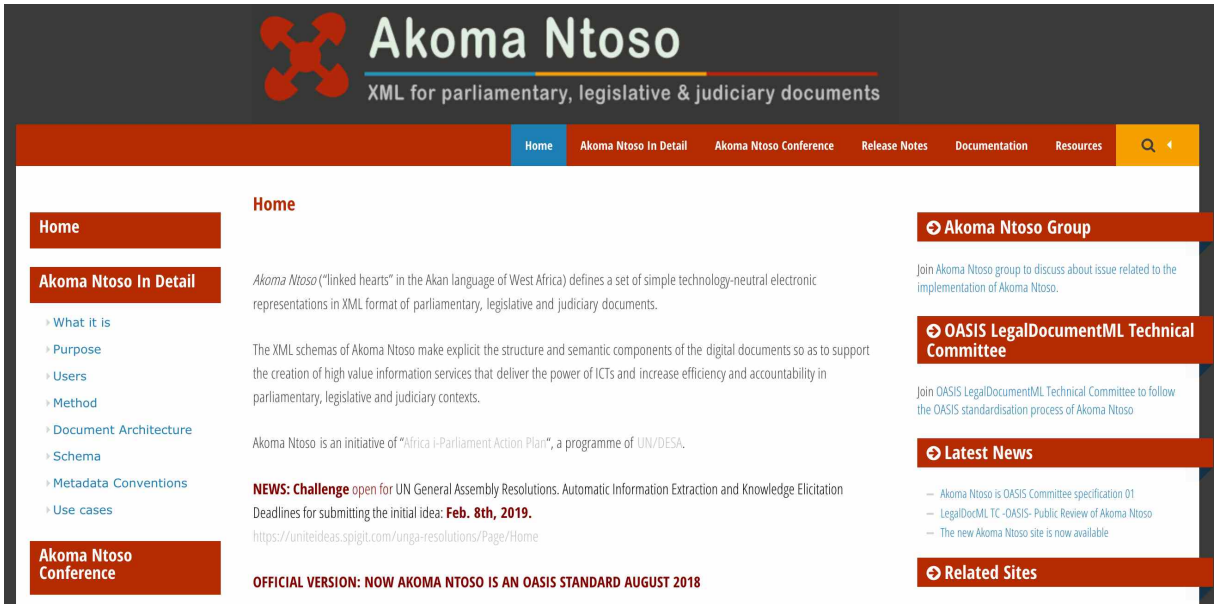

Figure 4.7.: Akoma Ntoso web page [14]. On the lower part communication about Akoma Ntoso as OASIS standard.

since *composed by* reflects a more procedural view of *agenda* as document for keeping the business of the assembly in order.

The relations between categories can be exploited for various applications, the traditional one being *information retrieval* while other applications are listed, for example, in [66], p. 272. The use of ontologies in *argumentation* has a rich literature, a detailed survey in relation to several theories of argumentation as in section3 can be found in [85]. A more specific presentation in relation to *Walton's theory of argumentation* (see appendix D) and the definition of a standard for *Argument Interchange Format — AIF —* through the web can be found in [77][1]. Management of changes in legal corpora is an old subject of study that, in the nineties, started to exploit the possibilities offered by *markup languages* like SGML [51] for keeping in order versions of legal documents in their context. Other markup languages, namely HTML and XML, have been used subsequently for this task and several projects and operational systems exist (for a survey until 2011, see [71]). It is remarked that ontologies for the classification of arguments in a debate are distinct from ontologies for the association of documents to the debate. In the first case, the classification is based on the structure of a discourse while in the second case, the classification is based on structure of a debate. Among the categories in the first case we can find *evidence, claim, rebuttal, backing, ...* while among the categories in the second case are we can find *rollcall, procedural motions, point of order, resolution, ...*. This second aspect of the use of ontologies for the classification of documents in relation to the structure of a debate has recently gained importance after the integration in *Akoma Ntoso* of a set of tags related to the unfolding of a debate.

Akoma Ntoso is an XML markup language whose origin is an initiative of the *Africa i-Parliament Action Plan* of the United Nations (Figure 4.7) in parallel to the *Bungeni* parliamentary tool (Section 4.2). Akoma Ntoso is today widely used as markup language for legal texts in parliament and is an OASIS standard[2]. Its further development in the direction of annotation of debates opens for its use for the association of documents to the debate's structure.

[1] A repository for AIF was created by one of the authors of [77], see `www.argumentinterchange.org`
[2] `https://www.oasis-open.org`

5. Position: Guarded Attributed Grammars for Structured Argumentations

1. Computer Modelling of the Conduct of Debates

A computer tool for the conduct of a debate must be able to organise the contributions of the various participants in order to produce coherent and well-documented arguments while accommodating incomplete or uncertain or even contradictory information. In addition, an interface must be provided that allows each user to have a synthetic view of the ongoing debate and how he or she can contribute to its progress according to the modalities defined by the argumentation schemes. The discussion is therefore constrained by the rules that govern the debate. This normative aspect of the conduct of the debate is what allows the system to continuously analyse the structure of the debate, without being aware of its actual content: the meaning of the propositional content of the various speech acts remains under the control of human participants for the sake of their mutual understanding. More precisely, each user's intervention takes the form of a text in which he or she expresses a proposal, an objection, introduces an illustration or a reference, or more generally makes an act of language (commitments, requests, declarations...). These elements do not make sense to the system, but the constraints imposed by the rules of conduct of the debate allow it to understand how they are articulated and thus to get an image of the structure the current debate. On this basis, the system can then propose interaction modalities to users (vigilance points related to critical questions, requests for clarification or additional arguments depending on the burden of proof...). Finally, the system must manage the information used and produced during the debate in order to present to each user the required information (where and when this information is needed) and to produce a summary of the current state of the debate.

We suggest to use **Guarded Attribute Grammars** (GAG) [5] to model both the structure of the debate and its conduct. It is a declarative model that focuses on task decomposition and the notion of user workspace. In the context of the conduct of a debate, the GAG model can be presented as follows. The workspace consists of a set of *artifacts* that represent the structure of the arguments in a hierarchical representation (a tree). Nodes have *sorts* defined in accordance with the typology of the debate (its ontology), e.g., issues, positions, arguments, critical questions... The content of a node gives the corresponding contribution to the debate (a text) together with contextual information (its *attributes*). The production of the grammar determine the logical structure of the argument, i.e. it shows how the different elements of a debate can be articulated. The leaves (or open nodes) of an artifact correspond to pending tasks where the contribution of a participant (or a class of participants) is expected or suggested: justifying an assumption, responding to an objection, raising an issue or introducing a proposition or a critical question... Each production is associated with a *guard* that identify the nodes where the production is applicable (based on available information at the node given by the values of its attributes). Finally, each production has *semantic rules* that manage the information flows between the attributes of the node where this production applies and the attributes of the nodes that are created when the production is applied. A *rule*, given by the joint data of a grammar production, its guard and its semantic rules, can thus represent, as the case may be, an argumentation

scheme or any other type of action envisaged.

In this way the workspace provides the user with a representation of the current discussion, a list of the points on which he or she is requested - the pending tasks - and for each of these the rules applicable to it with the information that is useful for him or her to decide on the rule to apply. An artifact represents an argument under construction. Its structure and rules of evolution must therefore correspond to the definition of the dialogical construction of the argument using speculative proof construction and refutation. Semantic rules must also help to evaluate (qualitatively or quantitatively) the arguments that appear in them. This is important because the degree of validity of an argument can condition (via the guards) the use of a rule at a remote node. A rule can also be used to create subdialogs of different kinds. Its semantic rules must then make it possible to initialise the parameters of the subdialogues and conversely to indicate how the results of these subdialogues are transmitted to the main dialog.

Our approach to formalising debate draws heavily on Walton and Krabbe's work and Van Eemerson and Grootendorst's pragmatic-dialectical approach. It is a dialogical approach to the regulation of debate that focuses on speech acts and the participants' commitments during the confrontation of their arguments. This dialogical approach is perfectly adapted to dialogues of the "persuasion" type where each participant seeks to establish his interpretation from assumptions initially granted by the other participants or conceded by them during the dialogue. In the case of a panel discussion aimed collectively at elucidating a given situation, Karl Popper and Imre Lakatos' evolutionary approach seems more appropriate to us. It allows the revision of the assumption (or their elimination) as a result of their critical examination by all participants. This approach emphasizes the speculative nature of knowledge (at a given time) and the progression towards a more relevant analysis (more in line with reality) through a dynamic error testing and elimination mechanism: *creation of a hypothesis, its critical examination and its correction (or suppression)*. We wish to combine aspects of rebuttal and hypothesis correction based on work on bi-intuitionist logic and belief revision theory. Qualitative methods will also be included to take into account uncertainty and imprecision and to provide a qualitative assessment of the arguments.

2. Guarded Attribute Grammars

In this section we describe in more detail the model of *Guarded Attribute Grammars* [5] in the context of distributed collaborative works for which this model was conceived. As part of his thesis, Robert Nsaibirni used the GAG model to build a prototype epidemiological surveillance system with geographically dispersed actors (doctors in the field, epidemiology experts, biologists, decision-makers...) some of whom regularly need to work in offline mode.

Guarded Attribute Grammars (in short GAG) is a user-centric model of collaborative work that puts emphasis on task decomposition and on the notion of user's workspace. We assume that a workspace contains, for each service offered by the user, a repository that contains one artifact for each occurrence of a service call (that initiates a so-called *case* in the system). An artifact is a tree that records all the information related to the treatment of the case. It contains open nodes corresponding to pending tasks that require user's attention. In this manner, the user has a global view of the activities in which he or she is involved, including all relevant information needed for the treatment of the pending tasks.

Each service is associated with a grammar that describes the dynamic evolution of a case. A production of the grammar is given by a left-hand side, indicating a non-terminal to expand, and a right-hand side, describing how to expand this non-terminal. We interpret a

production as a way to decompose a task, the symbol on the left-hand side, into sub-tasks associated with the symbols on the right-hand side. The initial task, namely the axiom of the grammar, is the service whereas the terminal symbols, namely the symbols that do not appear in the left-hand side of some production, are construe as calls to external services. For example, suppose we have two productions $p : A \to \varepsilon$ and $q : A \to B\ C$. Then in order to solve an A task the user may choose to apply production p (which corresponds to a certain action or activity) and this decision ends the performance of task A (since the right-hand side is empty). Alternatively production q may be chosen. In that case, two new (residual) tasks of respective sorts B and C are created and A will terminate as soon as B and C have terminated.

Information attached to a task are of two kinds: *inherited information* that comes from the context and is needed for the execution of the task, and symmetrically *synthesized information* that is generated during the execution of the task and is used by the context. Both types of information are used lazily and produced eagerly: one does not need to fully know the parameters of a task (value of its inherited attributes) to start executing it and partial values of synthesized attributes become available as soon as they are produced, even though they contains intentional value, namely sub-attributes whose values are not yet defined. The information, more precisely the inherited information, is used to determined which productions are enabled in the current configuration. For that purpose *guards* are attached to productions. They test whether inherited value follows some *pattern* and check that values extracted during this pattern matching satisfy some properties. As values are produced lazily, three results are possible when applying a guard to a pending task: It can fail, it can succeed, or there is not enough information to decide which of the two previous outcome applies. At any moment a user may apply a rule to expand a pending task whenever the corresponding guard is satisfied. If so, the pending task is replaced by the tasks on the right-hand side of the rule (if any) which become new pending tasks (each of which is either a local task or a call to an external service). Each production of the grammar is also equipped with *semantics rules* that basically serve as a glue between the task and its sub-tasks by making the necessary connections between the corresponding attribute values. More precisely they define the inherited information of the subtasks and the synthesized information of the task, the so-called *output values*, in terms of the values extracted during the pattern matching when evaluating the guard and the synthesized values of the subtasks, which jointly constitute the *input values* of the production semantic rules. We call *Business rule*, or simply a *rule*, the data made of a production together with a guard and semantic rules.

The main advantages of this model are as follows

Distribution Guarded attributed grammars can easily be implemented on a distributed architecture without complex communication mechanisms –like shared memory or FIFO channels. Indeed a user owns the open nodes that appear in his workspace and therefore there is no edition conflicts. The communication between active workspaces is implemented by asynchronous message passing.

Concurrency The lifecycle of a business artifact is implicitly represented by the grammar productions. As described above, a production decomposes a task into new subtasks and specifies constraints between their attributes using semantic rules. The subtasks may then evolve independently as long as the semantic rules are satisfied. The order of execution, which may depend on value that are computed during process execution, need not (and cannot in general) be determined statically. For that reason, this model dynamically allows maximal concurrency. In comparison, models in which the lifecycle of artifacts are represented by finite automata constrain concurrency among

tasks in an artificial way.

Reconfiguration The workflow can be reconfigured at run time: New business rules can be added to or deleted from the system without disturbing the current cases. By contrast, run time reconfiguration of workflows modeled by Petri nets (or similar models) is known to be a complex issue [65, 29].

Openness Semantic rules are arbitrary functions written in the host language in which the GAG specification is implemented. These semantics rules may then use external libraries and have side effects. For instance they may trigger real-world activities like extracting samples from a patient (in case of a medical process). As a side effect they may also send messages, perform verifications, etc. They may also be used to extract information from the current artifacts to build dashboards or to feed some local database that are later used to guide the user on her choice of the rule to apply for a pending task. They may, in a more coercitive fashion, suggest a specific rule to apply or even inhibit some of the rules. Some information from dashboards or contained in a local database can also be used to populate some input parameters of a rule in place of the user.

3. Conduct of Debate based on Guarded Attribute Grammars

Guarded Attribute Grammars can be useful for the conduct of debates on the following aspects:

Specifying roles and workspaces One can easily specify the roles of the various stakeholders (members of various committees or sub-committees, experts, lay citizens . . .), with their obligation and rights, and to structure their workspace accordingly. Each user will have, at any moment in time, a complete view on the tasks in which he or she is involved and on the related information.

Reporting Systems Guarded attribute grammar are particularly convenient to implement computer-assisted reporting systems where several users collaborate to build a document. The grammar can reflect the structure of the report, the identification of stakeholders and their respective contributions. The semantic rules describe how to buid the report from the many disparate information provided by the various contributors. Most often than not, many information to be inserted in a report are already available somewhere. The semantics rules should specify where each piece of information is produced and where it is used. In this manner they avoid redundancies and reduce workload: You write only once each piece of information, it is then collected in a synthesized attribute for further use. Guarded attribute grammars also avoid email overload — a problem that appears frequently when you have to coordinate a group of people to complete a shared activity — since most of the communication is directly made between the active workspaces (an information in an inherited position becomes available as soon as the system detects that it has been produced in the corresponding synthesized position at some possibly distant location).

Modelling speech acts As we saw pragmatics has a role in the design of computer tools for the coordination of tasks since the program coordinator of Terry Winograd and Fernando Flores [111]. The theoretical base of this program is the theory of speech acts originally introduced by John L. Austin [4] and subsequently elaborated by John R. Searle in [88] whose formalisation he conducted in collaboration with Daniel Vanderveken in [89]. Many business rules can be stated in terms of illocutionary acts: assertions, orders, requests, commitments, etc.

Conversely, me may envisage to derive a grammar from a description given in a (constraint) natural language made of sequences of illocutionary acts. More precisely, one can imagine to express the specification into (a subset of) *Attempto Controlled English*[1] (ACE) that can be parsed and transformed into (skeletons of) business rules, possibly using an intermediate representation into a fragment of illocutionary logic [89]. For instance a rewording of the statement "*an editor requests a referee for writing a report on a submitted paper and subsequently the referee accepts and commit himself in producing this report in the future*" in illocutionary logic should bring up the involved roles (editor and referee), the documents (submitted paper, report), the illocutionary acts (requesting, approving, committing oneself) with their strength (a request is weaker than an order), and their articulation in time (subsequently, in the future). This intermediate representation might then be used to derive a corresponding Guarded Attribute Grammar specification. The guard of a business rule, interpreted as a speech act, would describe (parts of) its felicity conditions and some synthesized attributes would correspond to the commitments that result from the performance of the speech act.

Invoking the crowd In the basic GAG-model each user renders a certain number of services and, for that purpose, can invoke services from other users. Each individual task is thus assigned to a specific user. In a crowd-sourcing context, a task can be entrusted to a pool of users. Not everyone will necessarily answer and the answers may be imprecise, uncertain and (partially) incompatible. The model can straightforwardly be adapted to allow right-hand side of productions to be dynamically determined as a result of the corresponding guard combined with the subsequent user's interactions (when he selects the production and configures it by providing additional data). Now the semantic rules would specify how to merge and incrementally reconcile the contributions of crowd-workers in order to produce information that can be used to allow rules for other tasks to be triggered.

Higher-order workflows Guarded Attribute Grammars whose right-hand side of productions are dynamically generated allows "higher-order workflows" in the sense that the value of an attribute (given by a participant or produced by semantic rules) might alternatively given as the result of an expression that represent a workflow whose execution would produce the required result. It means that instead of returning the required value one may return a recipe for computing it.

Modularity Guarded Attribute Grammars can be used to specify a particular debate (with productions associated with argumentation schemes) but also to combine debates of different types to obtain complex making-decision procedures involving information retrieval, expert advices, citizen polling, sub-decision processes ...

[1] `http://attempto.ifi.uzh.ch/site/`

6. Conclusions

The origin of this report was in our professional curiosity, as computer scientists, about the design of computer tools as elements of public debates. This topic is felt as important among computer scientists since the eighties and a wide literature is now published. Moreover, politics is paying attention and promoting both to the use of Information and Communication Technologies in parliaments (see Appendix C) and to the *engagement* of citizen's in the political debate (as an example, see the European Commission's communication *Better regulation for better results* [21]). The subject of *computers and debate* is consequently not only a matter of academic curiosity but is gaining more and more importance in our life.

As said in the Introduction, the two main communities of computer science addressing the topic of *computers and debate* are the *human-computer interaction* and the *artificial intelligence* ones. These two communities address the topic of debate from two distinct perspectives that, roughly speaking, are based on two distinct disciplines: *pragmatics* and *semantics*. We have not privileged one of these two perspectives and we tried to report the main ideas of both. Our understanding is that in both cases there are fundamental theoretical tools that should be used while reasoning about *computers and debate*. In section 3 we reported about the main ideas coming from these two perspectives.

We attempted to classify the types of possible computer tools for supporting a debate in relation to the *strength* of the procedural rules (table 1.2). This classification is naturally partial and eventually subject to revisions, for example by considering as a further parameter some *degree of delegation* given to the participants in the debate. In respect to *delegation*, we discussed in detail only the first of the classes in table 1.2, the *citizen societal debate* (section 2). This is in some sense a simple case since, for this class, there is no delegation at all and all the individual participants represent themselves. Nevertheless, we used table 1.2 as a kind of guideline for section 4 where we discussed examples taken from all of the listed classes.

Finally, section 5 reports about our position in respect to a possible formal model for the representation of debates via computers.

Several subjects have been touched only partially and should deserve further work. It is the case for what listed in the appendices that we consider as a kind of *pro memoria* for the continuation of our work.

APPENDICES

A. Rules of Procedure for Committees at the European Commission

The every-day activity of the European Commission depends at various levels from the work of *committees* whose subject of work can range from technical advice to international mediation. The functioning of these *committees* is very seldom informal. Informal conduct of the committee's works can happen, for example, in case of need for a punctual technical information to the Commission's staff. The great majority of cases, where the work of the committees has direct consequences to the decisions taken by the Commission and, possibly, an influence on the legislation of the European Union, are formally regulated either by one simple legal act or by a complex set of legal acts and consolidated practices. Committees for the *implementing acts* and the *delegated acts* of the European Commission are basic components of the functioning of the European Commission whose legal roots are in the treaties. In case of *implementing acts* and *delegated acts*, the EU legislation gives to the Commission the power for the *"implementation of legally binding union acts"* or delegates to the Commission the power to *"adopt non-legislative acts of general application"*. These powers, originally applied in the context of the Common Agricultural Policy, cover today several other important fields like taxation and health. As said, the legal justification for these powers given to the Commission comes from the treaties, as main reference we can quote articles 290 and 291 of the *Consolidated version of the Treaty on the Functioning of the European Union* [22]. In the application of these powers, the Commission is assisted by several committees, representing the Member States. The process of organization — and control by the Council and the Parliament — of, for example, the *implementing acts* is as well regulated by the European law [17]. The oveall activity related to the *implementing acts* is known in the Commission's jargon as *comitology*:

It is important to distinguish between the comitology committees on the one hand, and other entities, in particular 'expert groups' created by the Commission itself, on the other. The latter provide expertise to the Commission in preparing and implementing policy as well as delegated acts, whereas comitology committees assist the Commission in the exercise of the implementing powers that have been conferred upon it by basic legal acts.[36]

The information about the work of the committees is published on two distinct web-sites: the *Comitology Register* [34] for the committees related to the *implementing acts* and the *Register of Commission Expert Groups and other similar entities* [35] for all the other committees. Another interesting use of committes in the European Commission is associated to some kind of citizen's poll procedure. This is the case of the *Refit Platform* [20]. The *Refit platform* is composed by two committees and is under the responsibility of the first vice-president of the European Commission. The *Refit platform* [12]: *"supports the process of simplifying EU law and reducing regulatory burdens, for the benefit of civil society, business and public authorities"* and *"makes recommendations to the Commission, taking into account suggestions made by citizens and interested parties"*.

All the formal instances of *committees* in the European Commission have a common character: they adopt some *rules of procedure*. Let us consider the Commission Decision of 19 January 2012 on setting up of the European Union Offshore Oil and Gas Authorities Group [19]. The following excerpts taken from this decison are an example of the normal

procedure follwed while establishing such types of authorities and experts groups.

> Article 1: Subject matter. The European Union Offshore Oil and Gas Authorities Group [. . .] is hereby set up.
>
> Article 4: Membership — Appointment.
>
> 1 The Authorities Group shall be composed of Member States' authorities [...]
>
> 2 Member States' authorities shall nominate their representatives.
>
> 3 The names of Member States' authorities shall be published in the Register of Commission expert groups and other similar entities ('the Register').
>
> . . .
>
> Article 5: Operation
>
> 1 The Authorities Group shall be chaired by a representative of the Commission who may appoint a co-chair.
>
> 2 In agreement with the Commission services, the Authorities Group may set up sub-groups to examine specific questions, [. . .]
>
> 4 The Authorities Group and its sub-groups shall normally meet on Commission premises in accordance with the procedures and schedule established by it. If not otherwise provided, the Commission shall provide secretarial services.
>
> . . .
>
> 10 *The Authorities Group shall adopt its rules of procedure on the basis of the standard rules of procedure for expert groups.*

These *rules of procedure* are contained in the *Annex 3* of the *Commission Decision of 30.5.2016 establishing horizontal rules for the creation and operation of Commission Expert groups* [33]. In the same vein, the *Refit platform*, defines the *rules of procedure* for its committees in [20], article 5, in the following way: *"The groups shall adopt, in agreement with the chair of the Platform, their rules of procedure based on the standard rules of procedure for expert groups"*, with reference to the *Communication from the President to the Commission. Framework for Commission expert groups: horizontal rules and public register* [30] for the *"standard rules of procedure for expert groups"*. Specific *rules of procedure* are adopted by the individual committees operating in the *implementing acts* of the Commission and are published, group by group, in the *Comitology Register* web page [34]. Nevertheless, all these rules are similar and have as common frame [31]. Particular cases, like the *Appeal Committee*, that sometimes intervenes in the processes related to the *implementing acts*, have their *rules of procedure* explicitly published in the Official Journal [18].

In conclusion, a common frame of work for the committees in the European Commission can be found through their *rules of procedure* and some of the ideas contained in this report could be used for an analysis and, possibly, the design of a software tool helping the conduct of debate for such committees.

B. Performative Prefixes in Agreement with Robert's Rules of Order

Robert's rules of order establish a normative framework for the good development of assembly and parliament debates. From the perspective of pragma-dialectics, this is carried out by the means of speech-acts. Indeed, a particular utterance may imply the commitment of the speaker to support a determined procedure. Such an utterance is an integral part of the debate regulation, and often marks the start of the corresponding procedure. Performative prefixes are phrases used to formalise these speech-acts, as their use by a speaker unambiguously implies their commitment. We present some examples of these:

Main motion or question
I move that . . .
I move the adoption of the following resolution: '*Resolved*, That . . . '

Adjourn
I move to adjourn
I move to adjourn at . . .
I move that the meeting adjourn to meet at . . .
I move to adjourn sine die

Adopt
I move that the report be adopted . . .

Amend
I move to amend by adding . . .
I move to amending by inserting the word . . . before the word . . .
I move to amend by striking out the . . . paragraph . . .

Appeal, request for information, objections, points of order
I appeal from the decision of the chair
I object to the consideration of the question
I have a request for information
A point of information, please
Will the member yield for a question?
Point of order!
I rise to a point of order

Vote modes, Ballot, Division of the assembly
I move that the vote on the pending question be taken by ballot
Division!
I call for a division
I move that the vote be counted
I call for a separate vote on the . . . resolution . . .

Debate modes, limits

I move that during this meeting debate be limited to . . . minutes for each member

I move to divide the resolution so as to consider separately . . .

I move that the time for consideration of the pending resolution be extended for . . . minutes

I move to suspend the rules which interfere with continuing the consideration of the motion

I move that the motion be laid on the table

I move to postpone the question to the next meeting

I move to recess for . . . minutes

Minutes

I move that the minutes are approved as read

I move that the minutes are approved as corrected

I move to amend the minutes by . . .

I move that the reading of the minutes be dispensed with

C. ICT in Parliaments

This appendix recollects excerpts of the* World e-Parliament Report *series, published by the* Global Center for ICT in Parliament – United Nations, UN DESA *for the first 2008 [94], 2010 [95], and 2012 [96] instalments, and by the* Inter-Parliamentary Union *for the 2016 [48], and latest 2018 [49] reports.

1. Evolution of the use of ICT in Parliaments

This section summarises the outcome of the *World e-Parliament Report* series, which have spanned over ten years (2008-2018), and have traced through assessment and recommendations, the global use of ICT in assemblies.

> "*The World e-Parliament Reports, published in 2008, 2010, 2012, 2016 and 2018, help the parliamentary community ensure that their use of digital tools follows good practice; they highlight emerging trends and areas for improvement. The reports are also useful to civil society organizations wishing to build working relationships with parliaments; over a third of the parliaments now have a formal working arrangement with parliamentary monitoring organizations, which can serve as catalysts for greater public understanding and engagement.*" [49]

The 2008 report highlights the gap between few leading assemblies in the use of ICT, and the majority of them, showing a flagrant lack of technological support.

> " *The World e-Parliament Report 2008 constitutes the first assessment from a global perspective of how information and communication technologies (ICT) are being employed by parliaments across the spectrum of activities for which they are responsible. It is based on the responses and comments provided by 105 assemblies from around the world to a survey on the use of ICT in parliament.*
>
> **[. . .]**
>
> ***The higher end: extensive ICT use***
>
> *The analyses of responses from parliaments contained in this report show that some legislatures have been very successful in their use of ICT to support and even enhance their functions. Several of the institutions in this group have developed systems for managing most of their critical documents - bills, amendments, committee reports, plenary debate and votes - and are using open document standards for at least some of them. They have websites that present the most current activities of the parliament, many using both text and real time video formats, and are accumulating archives of this information. They have wide ranging information resources and are building a policy and legislative knowledge base, with numerous links of relevant documents and information to proposed bills, that is available to members and the public. Members have computers in their offices and a laptop that provides remote access to parliament and its information resources - both public and confidential - when they are in their home constituencies or travelling. Many are exploring new ICT-based methods for communicating with citizens and for engaging them in constructive discussions of policy options. But the percentage of chambers and parliaments that achieve this high level is*

small and falls entirely in the high or upper middle income groups. Based on the survey responses it is estimated to be less than 10%. And many of these chambers are not yet benefiting fully from ICT to support the values and goals of transparency, accountability, accessibility and effectiveness in carrying out their representative, legislative and oversight functions. Furthermore, the mere existence of a system or service as identified by the survey is not a guarantee of benefits for users and citizens. More attention needs to be given to evaluating the experiences to date and sharing the lessons learned.

The lower end: not meeting basic services

The ability of many chambers is significantly constrained by resources, some to the point that they cannot yet provide even the most basic ICT services. At least 10% of chambers and parliaments appear to fall into this group, and, based on responses to a variety of survey questions, the percentage could be as high as 30%. Results show that many have plans for building their capacities to use ICT and to enhance the effectiveness of their operations. Some have established strategic plans that can be implemented as the resources do become available, but it will take time to build the skills and applications that can adequately support their legislative and representational work. It will also require hard choices and a focus on the most important priorities from among the many that parliaments and parliamentarians might want to implement. Assistance from donors, international organizations and particularly from other parliaments to develop the capacity to transition from planning to implementation also will be needed. Those assemblies that have already made substantial strides in applying ICT should assist others that are only beginning this process through exchanging information, providing examples of good practices, and working collaboratively. There is, throughout the Report, a sense of a great opportunity for cooperation to help parliaments at earlier stages of technology "leapfrog" and better capitalize on the most recent advances in ICT. This is a comparative advantage, since technologically mature parliaments may have to deal with heavy ICT legacies and related organizational structures, while at the same time upgrading their infrastructure and applications to take advantage of and adapt to the latest developments. " [94]

Based on this outcome, this first report emitted the following technical recommendations:

"• *Implement a parliamentary information system, ensuring that it encompasses all bills and amendments, plenary debates and votes, and committee documents and actions.*

- *Create an authoritative, accessible, and engaging website that is accurate and timely, provides a complete and understandable view of parliamentary activities, offers multiple formats and channels of access, and contains the full range of institutional and legislative content.*
- *Adopt open standards and apply them to all legislative documents to facilitate wider citizens' access, the creation of a comprehensive legislative information resource that can be shared with others, integration of information and documents both internally and externally, and the establishment of a permanent digital archive.*
- *Build a technical infrastructure that is robust, flexible, secure and based on the strategic goals of parliament.*
- *Build a coherent knowledge base for parliaments that links all relevant internal and external information resources into an organized system that*

facilitates search and retrieval of needed information for members, staff, and the public.

- *Continue to explore opportunities for using technology to engage citizens and civil society, perform assessments of their utility, and adopt those that are found most useful for supporting fruitful interaction between parliament and the public.*" [94]

The 2018 report provides an account of the findings of the previous instalments of the series, tracing the evolution of ICT use in parliaments over the decade 2008-2018.

> "*This series of reports has come at a time of rapid evolution in parliamentary ICT. This was documented by means of surveys included in the first World e-Parliament Report, in 2008, and extensively updated in 2010, 2012 and 2016. The series sets out a range of challenges and opportunities for the use of ICT in parliaments. It paints a picture of potential that is limited in its realization by deficits in funding as well as knowledge, and by attitudes towards change. A narrative that runs across all the earlier reports is that parliaments are places where formal procedures are important but are also information-intensive environments. It is no surprise then to see parliamentary libraries singled out as places of innovation and leadership in managing and publishing information, documentation and data.*
>
> *The first report, in 2008, documented significant discrepancies between parliaments in high- and low-income countries, a recurring theme throughout the series thereafter. That first report highlighted the importance of ICT as a way to bring parliaments closer to citizens, but there were few practical examples at that early stage to demonstrate the principle, beyond published statistics and a few attempts at interactivity. Many parliaments, moreover, lacked a systemic view of ICT when that first report was done. As stated in the report's conclusions, there was a significant gap between what is possible with ICT and has actually been accomplished by parliaments so far. For many parliaments, that first report captured the early stages of a significant technological wave that would come to be seen as both disruptive and transformative over the next ten years.*
>
> *The 2010 World e-Parliament Report observed that the e-Parliament concept had been built upon the pillars of "active engagement, a clear vision, strategic planning, broad-based management and adequate resources". The report went on, however, to identify weaknesses in all of these areas. Forty per cent of the parliaments, for instance, lacked any strategic planning process, and only 43 per cent had a vision statement in place. Citing the importance of setting standards for the systems being used to manage digital documents, the 2010 report went on to highlight a lack of progress in this area since 2008, with fewer than half of parliaments using such a system and only a quarter using eXtensible Markup Language (XML) for any of their parliamentary documentation. Clearly, barriers remained.*
>
> *By the time of the 2012 report, many of the challenges noted in previous reports were still strongly evident. As suggested by the 2012 findings, however, limited but still important progress was being made in developing e-Parliament. More political leaders were engaged in setting institutional goals and objectives for ICT, and mobile devices and applications were being adopted more rapidly than expected. The use of XML to manage legislation was increasing notably; more parliaments had systems for managing plenary and committee documents; and both the willingness and follow-through of parliaments to share information and*

collaborate on improving technology had increased substantially. One example was the considerable progress made towards an international parliamentary and legislative XML standard, considered a key milestone in a parliament's digital maturity, allowing data to be exchanged across internal systems and to be more readily publishable.

[. . .]

As noted in that year's report, transforming legislatures into modern institutions capable of using technology effectively requires a strong commitment to transparency, accountability and accessibility. By 2012, Internet access was available in almost all parliaments, and most had wireless access. The series shows how the "soft" skills and attitudes of political leaders and members can be transformed to establish a culture of transparency, consistent with their responsibility as representatives of the people and with the values of citizens living in an information society. As the report observes, "promoting genuine dialogue with citizens and not just one-way communication goes hand-in-hand with greater transparency"*.*

The fourth report, published in 2016, showed that the deep changes reported in earlier editions – in the operational environment and cultural landscape of parliaments – had continued. By 2016, the digital parliament had become a distinct living entity, directly linked to constituents and the public in ways hard to imagine when the first World e-Parliament Report was issued. The 2016 report described parliaments as more outward-facing and open with stronger internal systems and processes – still challenged but getting better. Digital parliaments mirror the world around them, so it was not surprising to see social networks become important tools, allowing citizens to connect more often and more easily with parliaments and MPs. Another important trend was that documentation and content were being made more available, whether through web-based technologies or open data. On the other hand, many parliaments were hampered by lack of access to best practices and lack of support from the international donor community in new and emerging areas of ICT, such as open data. And this problem was exacerbated in low-income countries.

[. . .]

The 2016 report looked for the first time at parliaments' external partners. It concluded that PMOs could be active and effective partners for parliaments and that the more parliaments recognized the need to publish and disseminate data, the more valuable these intermediaries were likely to become.

[. . .]

The trend towards more open, publicly accountable parliaments continues to be seen throughout this **[2018]** *report; more parliaments are using open data and more are turning to the communication channels that the public uses. On the other hand, financial constraints, staff and member knowledge and capacity and member doubts about the reliability of these new technologies are challenges for many parliaments, regardless of their national income or level of economic development. Parliaments have reported progress in the management of information and the accessible publication of data.*

[. . .]

But in this 2018 report, what can actually be achieved with modern digital tools comes vividly into focus: the first reports of remote voting for plenary sessions. Parliaments are better connected to the outside world, as well, and on an increasingly two-way basis, with citizens given more opportunities to connect and get involved. A notable strengthening of ties with civil society is evident in

various parliaments too.

[. . .]

The 2016 report identified emerging technologies as the area with the greatest unmet demand for support. This 2018 report shows that parliaments require support right across the spectrum of digital tools, from planning and back-end systems to open data and citizen engagement. These findings strongly support evidence from 2016 that more and better coordinated efforts to share ideas and good practices among parliaments would be welcomed by many. This is about more than providing support, it is about developing a structured, clear and coordinated way to share support knowledge. " [49]

2. Open Source Initiatives, and Open Document Standards

The EU has, in the last decade, put forth efforts into recollecting and making data available to lay citizen, and the private sector. This data, arising from public institutions, different European Organisms, and EU funded scientific research, is intended to be available, not only for transparency purposes, but also to enhance efficiency, and an economical impact is expected. This is witnessed by the '*Open Data Initiative*' [32], or the '*Open Access Pilot in FP7*', the '*Open Research Data Pilot in H2020*', and the dedicated portal to EU open data[1].

In a wider international frame, with reference to the World e-Parliament Report series, we retain the importance of Open Data, and Open Document Standards, and the UN initiative for African parliamentary exchange and transparency.

"**[. . .]** *there are several related initiatives on open document standards underway in different parts of the world that are worth noting. Despite the challenges associated with implementing open document standards, the initiatives listed below have made significant progress and have begun to provide effective results in this field.*

[. . .]

At the international level a very good example is AKOMA NTOSO ("Architecture for Knowledge- Oriented Management of African Normative Texts using Open Standards and Ontologies"), a standard for legislative documents for Africa developed within the framework of the United Nations initiative "Africa i-Parliaments Action Plan". A suite of applications (named Bungeni) are also being developed to support the use of the standard. AKOMA-NTOSO provides an XML standard for legislative acts, legislative reports, debate reports, and other documents. A standard for judicial precedents is also being defined. " [94]

"**[. . .]** *the availability of open source software that can address the needs of parliaments is beneficial. While there are issues of training and support for these programmes, they have significant potential for ICT in legislatures and they continue to grow. Bungeni offers an example of complete applications built on open source software that support major parliamentary activities.*

[. . .]

Bungeni is an open source Parliamentary and Legislative Information System that aims to make parliaments more open and accessible to citizens, virtually allowing them "inside parliament", or "bungeni" in Swahili. The Bungeni system covers the entire document life-cycle of parliamentary documents from drafting to publication and supports the whole range of parliamentary documents: questions, motions, bills, tabled documents, etc. It meets typical legislative document

[1] https://data.europa.eu/euodp/en/home

archival requirements by recording multiple versions of a document at various points in time through various stages of the parliamentary process. " [95]

The 2016 and 2018 World e-Parliament Reports stress the role of Parliament Monitoring Organisations (PMOs). In their relation to Open Data the former states the following.

" *Open-source services and applications are particularly attractive to parliaments with limited budgets, as reflected in the findings of earlier World e-Parliament Reports. It is therefore unsurprising to see a continuing trend towards their use in smaller parliaments and those in lower-income countries. That trend is bolstered by international efforts to create open-source tools for parliaments, such as the Bungeni parliamentary information system and the Akoma Ntoso set of XML standards for parliamentary documentation. The parliaments in low-income countries tend to use open-source applications or platforms across a broader range of areas than the parliaments in high-income countries.*

One of the challenges with open-source applications and services can be the incorrect assumption that they entail no cost. Part of the package might indeed be cost-neutral, but parliaments must still support such products, just as they do in the case of commercial software. For small parliaments or those with limited ICT resources this can itself prove a challenge.

[. . .]

Open data is also about interoperability, letting others share, reuse and repurpose data. Yet three out of five of the PMOs do not use an open data standard. Those that do are more likely to use the civil society Popolo standard for their data schema; PMOs have not been adopting the Akoma Ntoso parliamentary standard, a finding that highlights both the sector's immaturity and the need to continue to promote open standards for parliamentary data. The value of this lies as much in the shareability of applications and components and the lower costs this brings as it does in the reliability and accessibility of the data itself.

This research shows that, despite challenges with funding, PMOs are thriving in an environment where there is an increasing public appetite for openness and transparency. On the back of new digital and social tools, these innovative organizations are holding parliaments and their members to account, a core feature of any strong democracy. They are educating and informing citizens and can reach audiences that can be difficult for parliaments to replicate. The parliamentary survey highlights the importance of open data and better citizen engagement, working with organizations that support stronger democracy. This research clearly shows that PMOs play a role in making parliaments stronger, more open and more accountable. " [48]

D. Walton's Approach to Logical Argumentation

This appendix recollects excerpts of the article [107] of D. Walton and F. Macagno.

> *" Argumentation schemes are stereotypical patterns of reasoning with a corresponding set of critical questions, namely defeasibility conditions. They represent patterns used in everyday conversational argumentation, and in other contexts such as legal and scientific argumentation."*

Argumentation schemes are hence a formalisation, as inference rules, of conversational arguments, and take the form of a collection of premises together with the conclusion that can be drawn from them. A particular focus is put on how these arguments can be opposed, and on the means that invalidate them, namely the associated *critical questions*. Through the critical questions, arguments are seen as *defeasible*, they can be refuted. The specificity of the weaknesses of arguments leads to myriads of argument schemes, as detailed in [108]. The systematic treatment of these schemes, given their number, calls for an appropriate taxonomy of arguments (see Figure D.1).

The major distinction that can be made, regarding argumentation schemes, is whether the judgement of the argument proponent can be questioned. Non source-based argument schemes can be derived without resorting to the speakers commitment or opinion. This class can be further subdivided into the epistemic reasoning arguments, based on logical inference, and practical reasoning arguments, in which the foreseeing of a causal implication serves as base for a decision.

Practical Reasoning Argument:
MAJOR PREMISE: I have a goal G.
MINOR PREMISE: Carrying out action A is a means to realize G.
CONCLUSION: Therefore, I ought (practically speaking) to carry out this action A.

The most obvious critical question associated with this type of argument is whether A is the only means to achieve G, and if other means could be more suitable. Another critical question regards the major premise, suggesting that the proponent revise their goal.

Among the most elementary epistemic reasoning arguments, one can find a Modus Ponens scheme, in which focus is put on the defeasibility of the implication.

Defeasible Rule Argument:
MAJOR PREMISE: If statements $P_1, P_2, \ldots, P_n$ apply, then statement Q may be inferred.
MINOR PREMISE: Statements $P_1, P_2, \ldots, P_n$ apply.
CONCLUSION: Q may be inferred.

In general, argument schemes are presented in such a way that the critical questions arise from raising doubts about the premises. In this case, a Modus Ponens inference can be opposed by questioning the inference rule (Major Premise), or the implication hypothesis (Minor Premise).

Defeasible rule arguments can be further subclassified as depicted in Figure D.1. Among epistemic arguments, we find discovery arguments of particular pertinence in relation to the work of Hintikka [52].

Argument from Sign:

SPECIFIC PREMISE: A (a finding) is true in this situation. (i.e. A has been observed)

GENERAL PREMISE: B is generally indicated as true when its sign, A, is true.

CONCLUSION: B is true in this situation.

Note that critical questions, in this case, revise that A has been actually found to be true, and that A is in general a sign of B.

Source-based argument schemes are those in which the conclusion relies on the trust put in an information source. A classical example of this sort is the following.

Argument from Position to Know:

MAJOR PREMISE: Source a is in position to know about things in a subject domain S containing proposition A.

MINOR PREMISE: a asserts that A is true.

CONCLUSION: A is true.

This is the paradigmatic scheme that displays the judgement of an expert. Such arguments are defeasible by questioning either that a is an actual expert in S, or that a has actually asserted A and she was not, for instance, misunderstood. Note that in this type of scheme, expert a can not be discredited, but her field of expertise can be put into question.

A specific class of argument schemes is meant to discredit a proponents argument. These are gathered under the tag Ad Hominem arguments, among which the simplest example is as follows:

Direct Type Ad Hominem Argument:

PREMISE: a is a person of bad character.

CONCLUSION: a's argument should not be accepted.

Note that this kind of argument relies solely on the judgement made about a, and can often be considered a fallacy. More complex Ad Hominem schemes overcome this judgement dependence by offering partial inferences on the character of a, and offer therefore as critical questions whether these inferences are sound. For instance, a way to discredit a proponent is by showing that their commitment is inconsistent, thus proving their judgement to be unreliable.

Circumstancial Ad Hominem Argument:

INITIAL COMMITMENT PREMISE: a has claimed or indicated that he is committed to proposition A (generally, or in virtue of what he said in the past).

OPPOSED COMMITMENT PREMISE: other evidence in this particular case shows that a is not really committed to A.

CONCLUSION: a's commitments are inconsistent.

Ad Hominem arguments are attacks to a proponent's credibility, however, their critical questions allow him to defend himself. For instance, in this case he could question his initial commitment, or otherwise question the evidence of him not being committed to A.

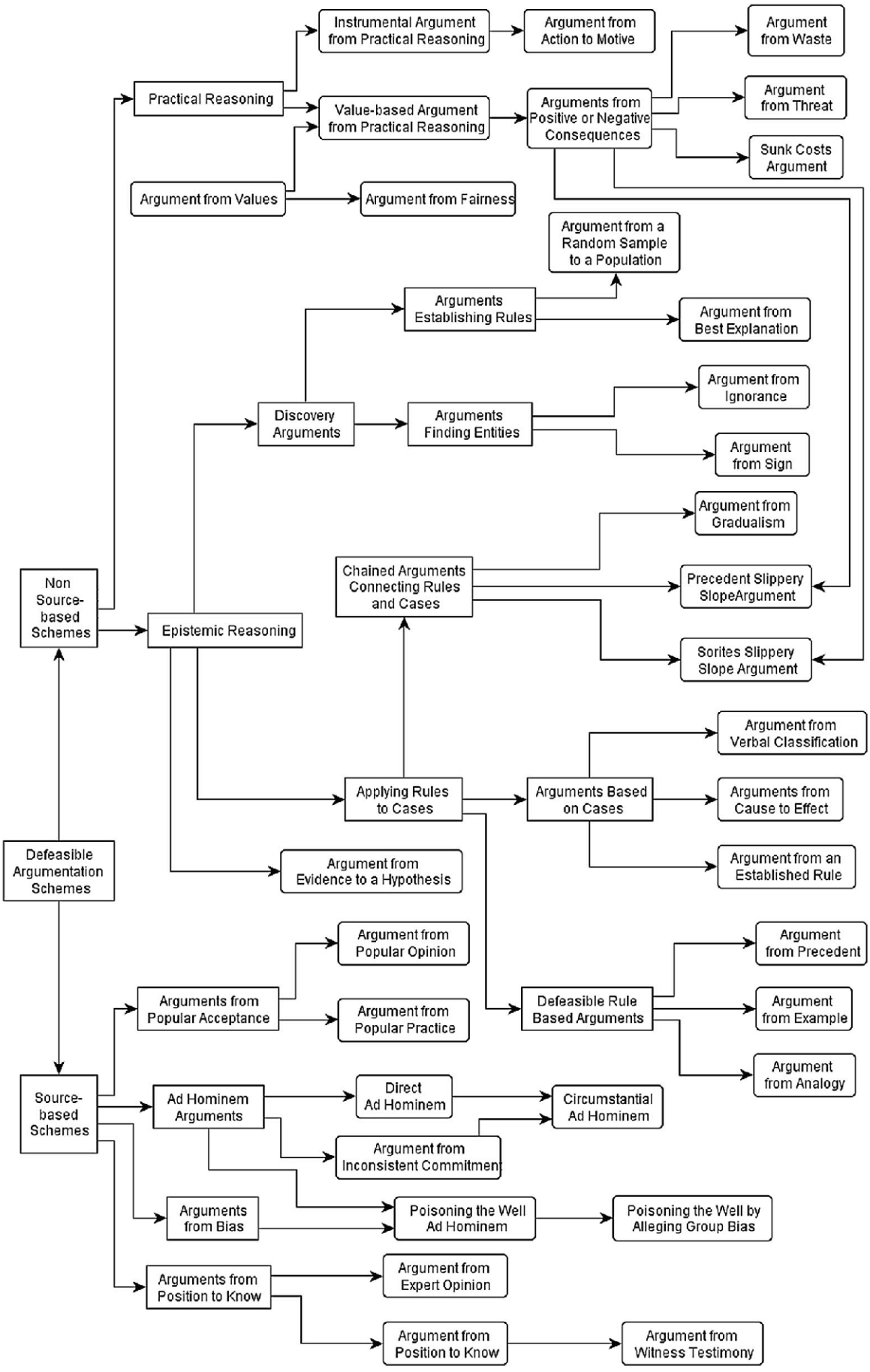

Figure D.1.: Figure taken from [107]: Classification of argumentation schemes.

E. The Pragma-Dialectical Approach to Argumentation

This appendix is made from excerpts from the book [103].

For Aristotle, dialectics is about conducting a critical discussion that is dialectical because a systematic interaction takes place between moves for and against a particular thesis. The purpose of the discussion is to examine whether a difference of opinion about the acceptability of a standpoint can be resolved my means of a regulated exchange of ideas. The language of argumentation has a purposive activity determined by its function in the regulation of disagreement. The various moves that are made in the different stages of a critical discussion in order to arrive to a resolution of a difference of opinion can be pragmatically characterized as speech acts. We concentrate on the obligations (commitments) that are created when people performs the speech acts.

Pragma-dialectics distinguishes four stages in the resolution of a difference of opinion :

- **The confrontation:** Explicitation of the difference of opinion.
- **The opening:** Mutual commitment to a common starting points : discussion format and rules, background knowledge, values.
- **The argumentation:** Argumentation is not only advanced, but also critically evaluated.
- **The conclusion:** The parties agree on the result of the discussion.

Distribution of speech acts in a critical discussion

Confrontation

***Assertive*:** Expressing a standpoint.

***Commissive*:** Acceptance or non-acceptance of a standpoint, upholding non-acceptance of a standpoint.

***[Directive]*:** Requesting a usage declarative.

***[Usage declarative]*:** Definition, specification, amplification, etc.

Opening

***Directive*:** Challenging to defend a stanpoint.

***Commissive*:** Acceptance of the challenge to defend a stanpoint, Agreement on assumptions and discussion rules, Decision to start a discussion.

***[Directive]*:** Requesting a usage declarative.

***[Usage declarative]*:** Definition, specification, amplification, etc.

Argumentation

***Directive*:** Requesting argumentation.

***Assertive*:** Advancing argumentation.

***Commissive*:** Acceptance or non-acceptance of argumentation.

***[Directive]*:** Requesting a usage declarative.

***[Usage declarative]*:** Definition, specification, amplification, etc.

Concluding

***Commissive*:** Acceptance or non-acceptance of a standpoint.

***Assertive*:** Upholding or retracting a standpoint, Establishing the result of the discussion.

***[Directive]*:** Requesting a usage declarative.

***[Usage declarative]*:** Definition, specification, amplification, etc.

The starting point of the critical perspective is that we cannot be certain of anything. It encourages the systematic submission of the one's party standpoints to the other party's critical doubts. In this way, an explicit argumentation is elicited. This, in turn, can be called into question until the difference of opinion is resolved in a manner that is acceptable to the parties involved. In this perspective, all argumentation is regarded as a part of a critical discussion between parties that are prepared to abide by an agreed discussion procedure.

The theoretical model of a critical discussion is dialectical because it is premised on the two parties who try to resolve a difference of opinion by means of a methodical exchange of discussion moves. The model is pragmatic because these discussion moves are described as speech acts that are performed in a specific situation and context. The code of behavior for conducting a reasonable discussion derives its problem validity precisely from the fact that it does not allow any fallacies.

Rules for a critical discussion

Rule 1. Unconditional right to put forward or to call into question every standpoint.

(a) Special conditions apply neither to the propositional content of the assertives by which a standpoint is expressed, not to the propositional content of the negation of the commissive by means of which a standpoint is called into question.

(b) In the performance of these assertives and negative commissives, no special preparatory conditions apply to the position or status of the speaker or writer and listener or reader.

Rule 2. The right to challenge. The discussant who has called the standpoint of the other discussant into question in the confrontation stage is always entitled to challenge this discussant to defend his standpoint.

Rule 3. The obligation to defend. The discussant who is challenged by the other discussant to defend the stanpoint that he has put forward in the confrontation stage is always obliged to accept this challenge, unless the other discussant is not prepared to accept any shared premises and discussion rules; the discussant remains obliged to defend the standpoint as long as he does not retract it and as long as he has not successfully defended it against the other discussant on the basis of the agreed premises and discussion rules.

Remarks:

1. A discussant who has successfully defended a standpoint is not subsequently obliged to defend the same standpoint again according to the same discussion rules and with the same premises against the same discussant (*non bis in idem*). This principle does not apply to discussions either with a different challenger, or with the same challenger but with different premises, or different discussion rules. An argumentative dispute can in principle never be settled once and for all.

2. Rule (3) states a (conditional) obligation to defend in principle. But it may be impossible to comply with this obligation immediately in pratice. For example the discussant may want to document or prepare his case more thoroughly. It indicates his preparedness to discuss. The discussant who has challenged him can in turn indicate his preparedness to discuss by agreeing premises and discussion rules.

3. This rule also regulates how the onus of proof with regard to a standpoint is distributed (allocation of the burden of the proof).

Rule 4. Allocation of the discussion roles. The discussant who in the opening stage has accepted the other discussant's challenge to defend his standpoint will fulfilled the role of protagonist in the argument stage, and the other discussant will fulfill the role of antagonist, unless they agree otherwise ; the distribution of the roles is maintained until the end of the discussion.

Rule 5. Shared rules of discussion. The discussants who will fulfill the roles of protagonist and antagonist in the argumentation stage agree before the start of the argumentation stage on the rules for the following : how the protagonist is to defend the initial standpoint and how the antagonist is to attack it, and in which case the protagonist has successfully defended the stanpoint and in which case the antagonist has successfully attacked it. These rules apply throughout the duration of the discussion, and may not be called into question during the discussion itself by either of the parties.

Rule 6. Attacking and defending standpoints.

(a) The protagonist may always defend the standpoint that he adopts in the initial difference of opinion or in a sub-difference of opinion by performing a complex speech act of argumentation, which then counts as a provisional defense of this standpoint.

(b) The antagonist may always attack a stanpoint by calling into question the propositional content or the justificatory or refutatory force of the argumentation.

(c) The protagonist and the antagonist may not defend or attack standpoints in any other ways.

Rule 7. Success conditions: Propositional content.

(a) The protagonist has successfully defended the propositional content of a complex speech act of argumentation against an attack by an antagonist if the application of the intersubjective identification procedure yields a positive result or if the propositional content is in the second instance accepted by both parties as a result of a sub-discussion in which the protagonist has successfully defended a positive sub-standpoint with regard to this propositional content.

(b) Otherwise the antagonist has successfully attacked the propositional content of the complex speech act of argumentation.

Rule 8. Success conditions: Complex speech act.

(a) The protagonist has successfully defended a complex speech act of argumentation against an attack by the antagonist with regard to its force of justification or refutation if the applcation of the intersubjective inference procedure or (after application of the intersubjective explicitization procedure) the application of the intersubjective testing procedure yields a positive result.

(b) Otherwise the antagonist has successfully attacked the force of justification or refutation of the argumentation.

Rule 9. Success conditions.

(a) The protagonist has conclusively defended an initial standpoint or substandpoint by means of a complex speech act of argumentation if he has successfully defended both the propositional content called into question by the antagonist and its force of justification or refutation called into question by the antagonist.

(b) The antagonist has conclusively attacked the standpoint of the protagonist if he has successfully attacked either the propositional content or the force of justification or refutation of the complex speech act of argumentation.

Rule 10. Right to call into question. The antagonist retains throughout the entire discussion the right to call into question both the propositional content and the force of justification or refutation of every complex speech act of argumentation of the protagonist that the latter has not yet successfully defended.

Rule 11. Right to defend. The protagonist retains throughout the entire discussion the right to defend both the propositional content and the force of justification or refutation of every complex speech act of argumentation that he has performed and not yet successfully defended against every attack by the antagonist.

Rule 12. Retraction. The protagonist retains throughout the entire discussion the right to retract any complex speech act of argumentation that he has performed, and thereby to remove the obligation to defend it.

Rule 13. Performance of speech acts.

(a) The protagonist and the antagonist may perform the same speech act or the same complex speech act with the same role in the discussion only once.

(b) The protagonist and the antagonist must in turn make a move of (complex) speech acts with a particular role in the discussion.

(c) The protagonist and the antagonist may not perform more than one move of (complex) speech acta at one time.

Rule 14. Obligation of the discussants.

(a) The protagonist is obliged to retract the initial standpoint if the antagonist has conclusively attacked it (in the manner prescribed in rule 9) in the argumentation stage (and has also observed the other discussion rules).

(b) The antagonist is obliged to retract the calling into question of the initial standpoint if the protagonist has conclusively defended it (in the manner prescribed in rule 9) in the argumentation stage (and has also observed the other discussion rules).

(c) In all other cases, the protagonist is not obliged to retract the initial standpoint, no is the antagonist obliged to withdraw his calling into question the initial standpoint.

Rule 15. Usage declaratives.

(a) The discussants have the right at every stage of the discussion to request the other discussant to perform a usage declarative and to perform one themseves.

(b) The discussant who is requested to perform a usage declarative by the other discussant is obliged to act accordingly.

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